PRIMARY SCIENCE

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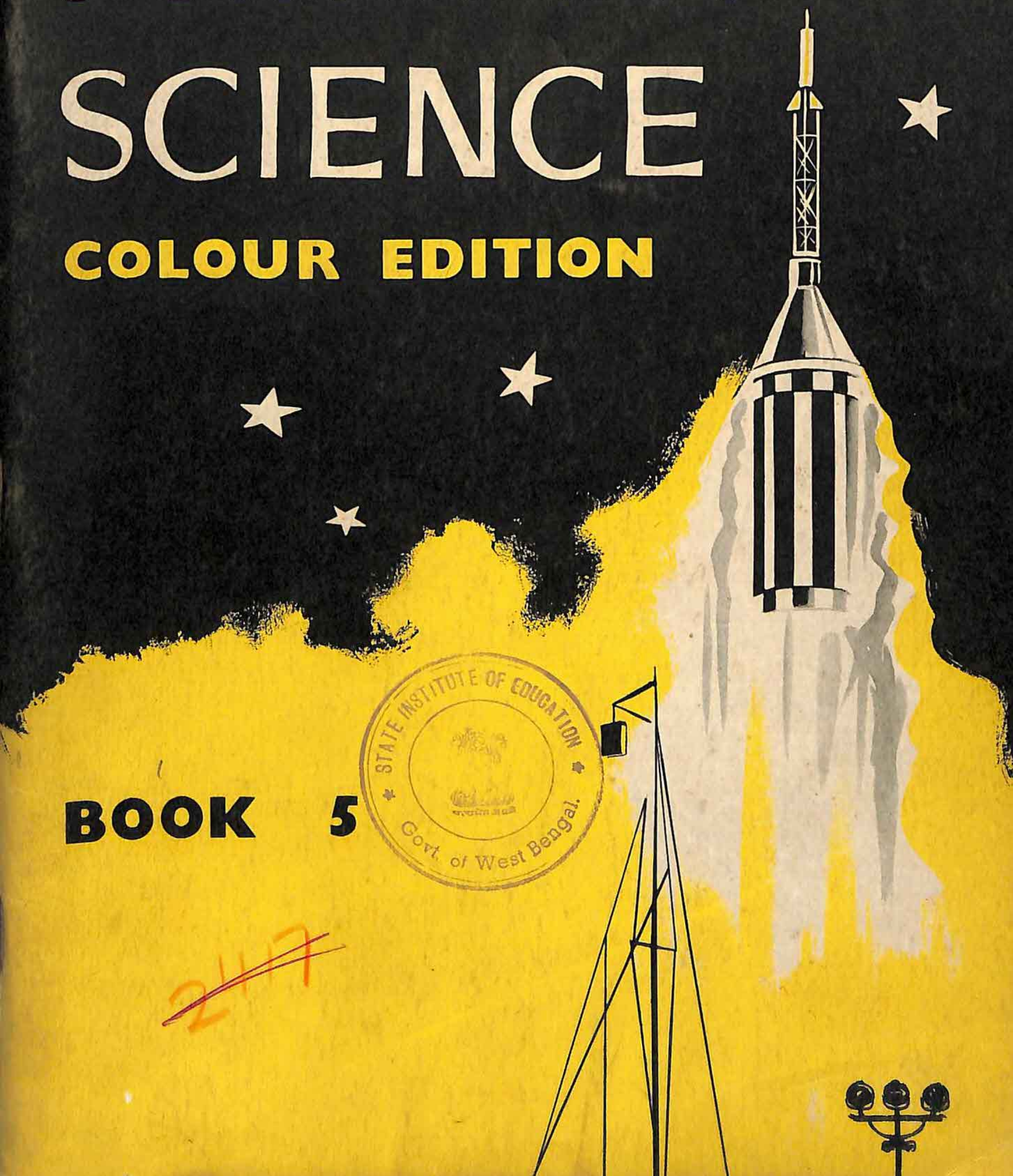

BOOK 5

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PRIMARY SCIENCE SERIES

FOR INDIA

BOOK 5

Adapted for India
by
V. N. Narawane, M.Sc., M.Ed.

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PRIMARY SCIENCE SERIES

First Year	Introductory Book	
First Year	Book 1	Living Things — Living Things Grow — Living Things Move — Living Things need Food and Water — Animals Grow — Plants Grow — Animals Move — Animals Eat — Animals and their Babies — Trees, Shrubs and Climbers — Parts of a Tree — Birds — Birds and their Babies — Birds lay Eggs and look after Young — Living Things in Water — Living Things on Land.
Second Year	Book 2	Fruits and Seeds — Growing Seeds — How Fruits are Formed — Growing Plants — Plants as Food — Frog — Butterfly — Lizard — Fish — Bird — Rabbit — Snail.
Third Year	Book 3	Plants need Water — Plants give out Water — Growing Seeds — Animals need Water — Leaves — Animals protect Themselves — Plants protect Themselves — Cockroach — Housefly — Mosquito — Frog — Butterfly — Bird.
Fourth Year	Book 4	The Earth and the Sun — Soils — Flowering Plants — Study of Sea Fishes — Animals of the Sea Shore — Sea Animals — Air — Water — Air Pressure.
Fifth Year	Book 5	More about Air — Human Skeleton — Food — Teeth — Blood Circulation — Breathing — Body Waste — Parasites — The Moon — Erosion — Machines — Weights.
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All the books contain 'things to do' or practical experiments to perform. Questions are included at the end of each lesson or chapter.

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AIR

What do you know about air?

You already know that air is something **real,** though you cannot see it, touch it or smell it. You can only feel the air rushing at you when there is a wind. This is because wind is in fact moving air.

When you see an "empty" bottle it is not exactly "empty", because it contains air. If the bottle is large, the amount of air in it is more and if the bottle is small the amount of air in it is less.

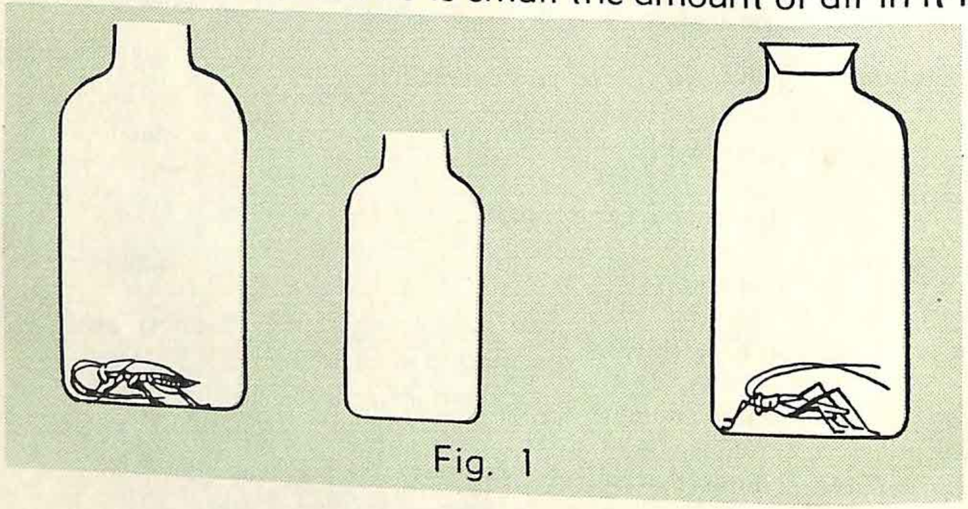


Fig. 1

Air is important to animals and plants. An animal can live without food for many days, but it cannot live for long if it has no fresh air. That is why a cockroach dies if it is kept in a corked bottle for some time. A plant, too, cannot live for long if it has no air.

Air is important for many other reasons. Things cannot burn if they have no supply of fresh air. For example, if you pour sand over a burning fire it dies, because it has no air. On the other hand, if you fan the fire it burns more brightly and the fire becomes bigger and bigger.

Iron nails cannot become rusty if there is no air.

Air is a mixture of invisible gases; the most important ones are **oxygen, nitrogen, carbon dioxide** and **water vapour.**

In breathing, animals and plants take in oxygen and give out carbon dioxide.

You will find from experiments that about 1/5 of the air in the atmosphere is **oxygen,** while the other 4/5 is nitrogen. There is very little carbon dioxide in the air.

EXPERIMENT 1: To show that a candle needs a supply of fresh air for it to burn.

Things to get: Two pieces of cardboard, two clothes pegs, a chimney glass, and a candle.

Things to do:

1. Stick the candle on the board, using some melted wax.
2. When the candle is burning cover it with the chimney glass.
3. Cover the top opening of the chimney glass with a piece of cardboard and notice the time it takes for the candle to go out.
4. Remove the chimney glass. Place two clothes pegs under the glass so that air can enter. Re-light the candle and cover it again with the chimney glass. Why does the candle keep on burning?

…………………………………………………………………

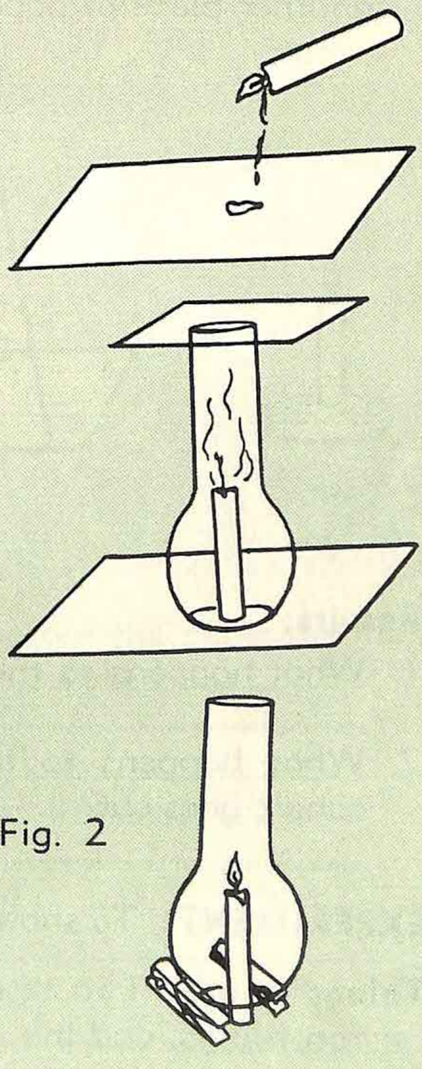


Fig. 2

EXPERIMENT 2: To show that about 1/5 of the air is used up when a candle burns.

Things to get: A candle, a small piece of cork, a glass vessel, and a tin of coloured water.

Things to do:

1. Put the glass vessel upside down in the tin of water and stick a piece of paper on it to mark the level of the water.
2. Remove the vessel, light the candle, place it on the cork and float it in the water.
3. Slowly and carefully cover the burning candle with the glass vessel.
4. Watch the burning candle and the level of water in the vessel.
5. Leave the vessel to cool for a few minutes, and then stick another piece of paper on the jar to mark the new level of the water.

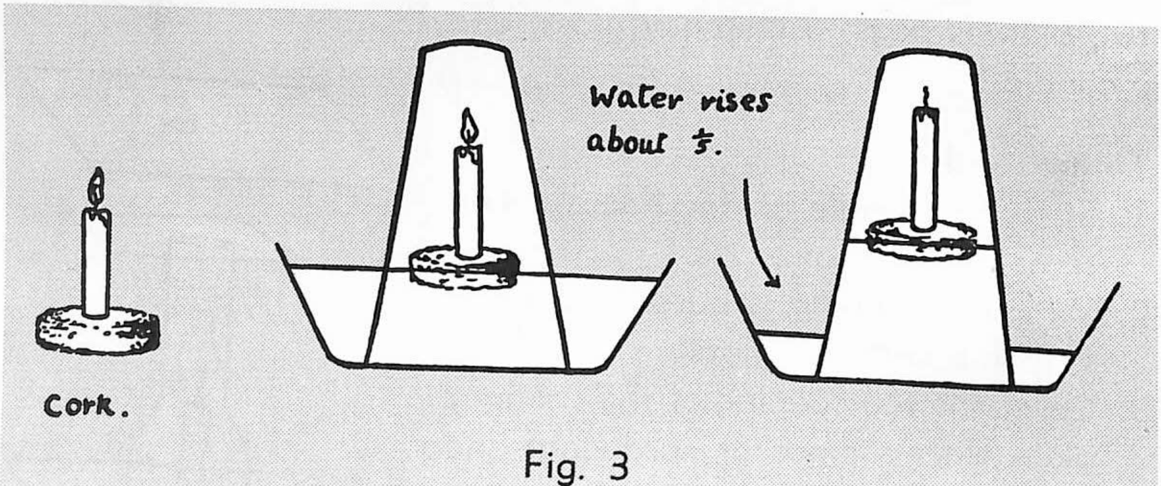


Fig. 3

Results:

1. What happens to the burning candle?

....

2. What happens to the level of water in the vessel when the candle goes out?

....

EXPERIMENT: To show that rusting uses up some air.

Things to get: Two test-tubes, corks with glass tubes, steel wool or iron filings, and ink.

Things to do:

1. Note the colour of the steel wool. Wet it.
2. Put some into test-tube A and leave empty. Insert the glass tubes into the test tubes.
3. Put the two tubes in the bottle of water coloured with ink as shown below. Note the level of water in the two tubes.
4. Leave them for a day and see what happens:
   (a) to the steel wool
   (b) the level of water in the glass tube connected to A.

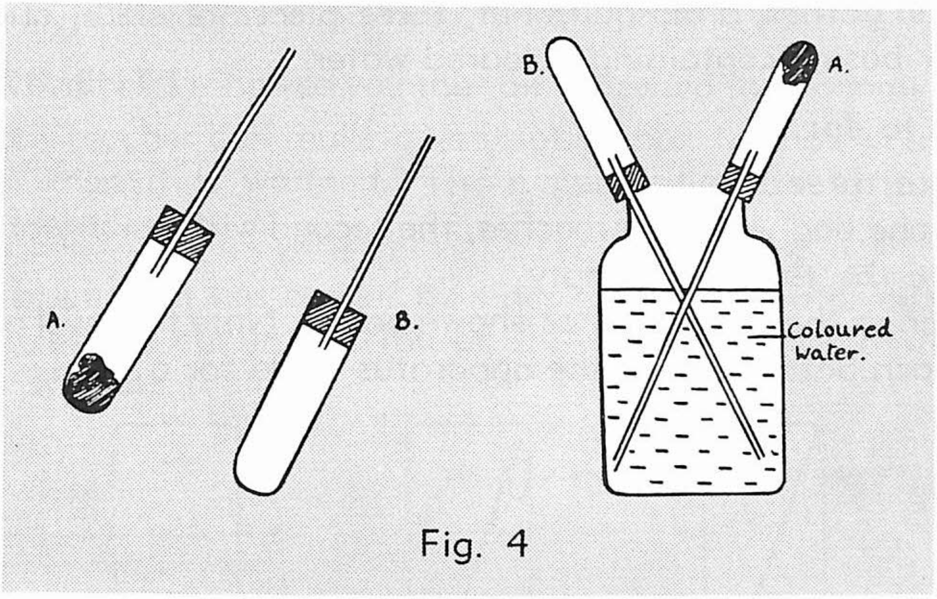


Fig. 4

Results:

1. What was the colour of the steel wool before the experiment?

   ....

2. What is steel wool made of?

   ....

3. What is the colour of the steel wool after the experiment?

   ....

4. Where was the level of water in tube A?

   ....

5. Is the level of water in B the same as in A?

   ....

6. Does the level of water in tube A rise at the end of the experiment?

....

7. Does the level of water in tube B rise at the end of the experiment?

....

8. Make drawings to show the end of your experiment.

EXPERIMENT: To show that breathing uses up some air.

Things to get: Live cockroaches, live earthworms, three wide-mouthed bottles, a mosquito net, three pieces of stick, and three shallow basins containing coloured water.

Things to do:

1. Make three small bags.
2. Fill one bag with cockroaches, the second with earth-worms and leave the third one empty.
3. Arrange the apparatus as shown below. Note the level of water in each bottle. Leave the apparatus aside for a day.

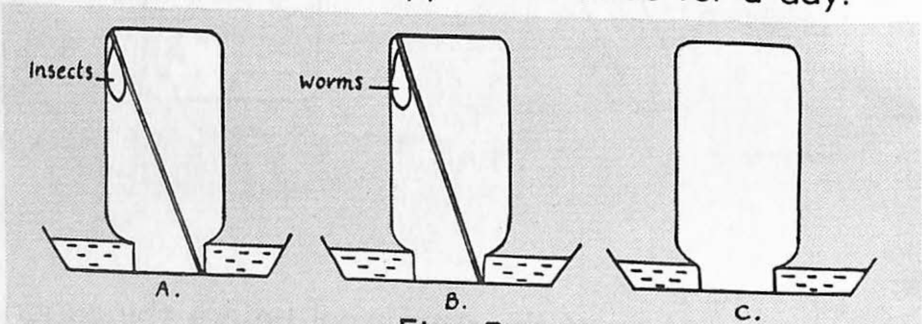


Fig. 5

Results:

1. Where is the level of water in each bottle at the beginning of the experiment?

....

2. What happens to the level of water in A ....
.... in B ....
.... in C? ....
....

3. Why does water rises in A and B but not C?

....

4. What does this experiment show?

....

Make a diagram showing the beginning and end of your experiment.

From the experiments you have done it is quite clear that air is very important. Air is used in burning, breathing and rusting.

We have also learned that about 1/5 of the air is oxygen, the gas that is needed for burning, breathing and rusting.

EXPERIMENT 1 : Showed you that air is needed for a candle to burn.

Your teacher can make a ventilation box to show you how air moves when it is warmed. The movement of air in this way is called **ventilation.**

A biscuit tin has one of its sides replaced by a piece of glass. Two holes are cut in the top of the tin and covered with wide pieces of glass tubing.

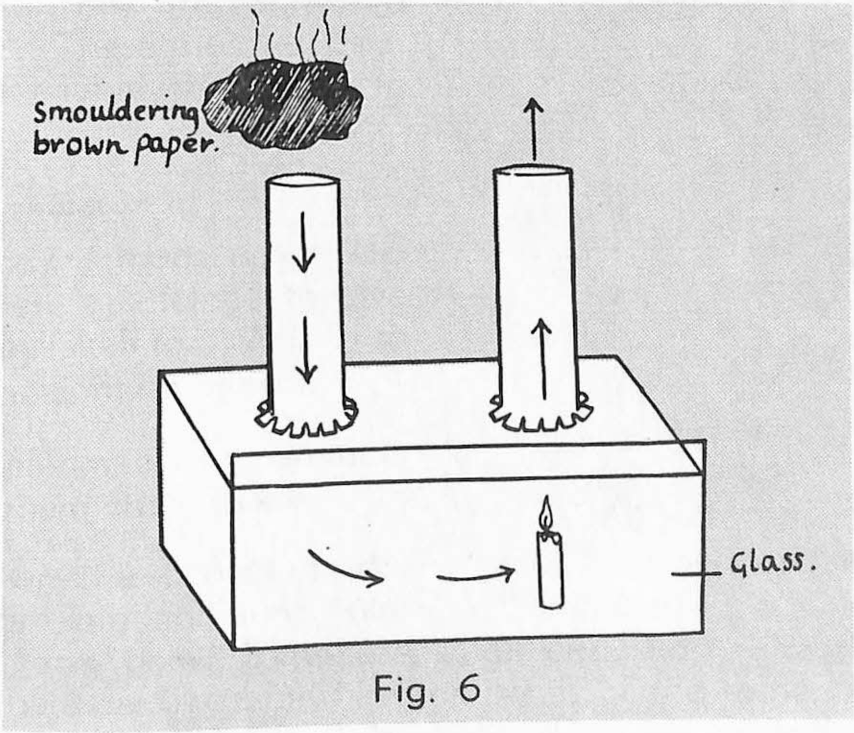


Fig. 6

A burning candle is placed under one tube. When your teacher holds a piece of smouldering brown paper over the other tube, you will see the smoke moving up the tube above the candle and down the other one. This shows you how warm air rises and cooler air flows in to take its place.

EXERCISE.

Choose the correct word or words from those given in brackets to complete the sentence.

1. Air is real because it .... (takes up space, cannot be seen, has no smell).
2. Things cannot burn if there is no .... (oxygen, carbon dioxide, nitrogen).
3. Air is necessary for burning, rusting, and .... (Smelling, running, breathing).
4. About .... ($\frac{1}{2}$, 1/5, 2/5) of the air is oxygen.

CHAPTER 2

BONES AND BODY SKELETON

Bones are wonderful things. They are living things. They take in food, they grow. They are made up mainly of two important minerals called **calcium** and **phosphorus.** That is why you must eat food that contains these two kinds of mineral.

When you are young, your bones are soft and can be easily bent. For this reason it is important that babies should not be allowed to stand when their bones are not strong. As you grow older your bones become strong and hard.

Uses of bones

Bones form a framework. The framework of bones protects many soft parts of the body such as the brain, the lungs and the heart.

Bones cannot move by themselves. They are connected by muscles. These muscles form joints and enable the bones to move.

The body skeleton

The body is made up of 216 bones. These are joined to give you a **bony skeleton.** This also gives you a **definite shape.**

The skeletons of other animals also give them their shape.

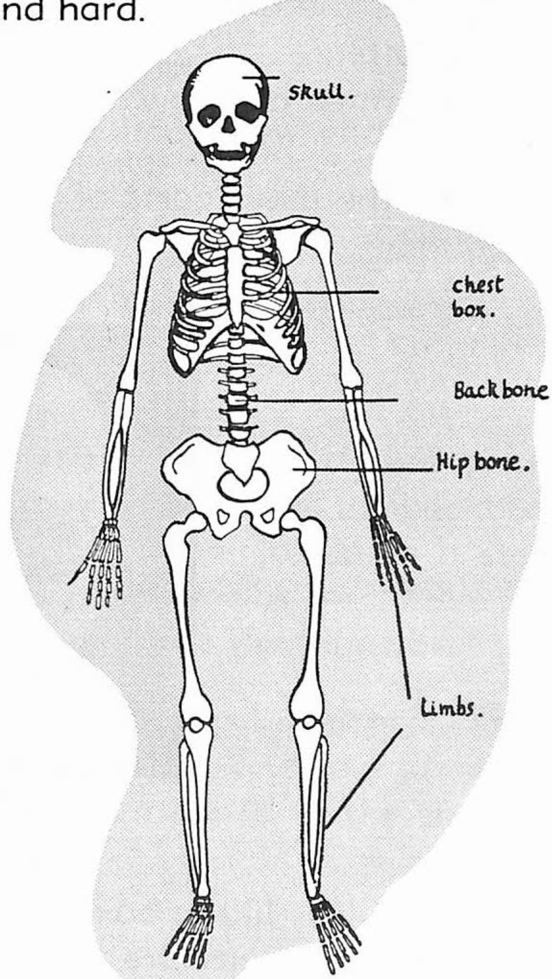


Fig. 7

Some of the bones of the skeleton are big and long, like the upper arm bone. Some are small and short, like the wrist bones. Others are irregular, like the bones of the spine.

The bony skeleton is made up mainly of the following parts:

1. The skull
2. The chest box
3. The backbone
4. The hip bone
5. The limbs (hands and legs)

Answer these questions:

1. What must your food contain if you are to have strong bones?
....
2. What is the difference between the bone of a baby and that of an adult? ....
3. Name three organs which the skeleton protects.
....
4. Name the main parts of the skeleton.
....

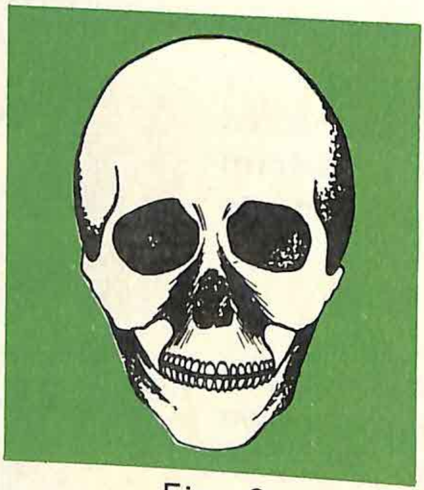


Fig. 8

The skull is like a box which is composed of many thin round bones. These bones are bound together. The skull is further protected by a skin and elastic muscles.

The skull encloses and protects a very important organ – the brain. The skull has holes for the eyes, the ears and the nose.

The lower jaw is joined to the skull at one point in such a way that it can move up and down, but the upper jaw is fixed to the skull so that it cannot move at all.

In the jaws are teeth. The teeth are fitted into holes called **sockets.** There are 16 teeth in the upper jaw and the same number in the lower one.

Answer these questions:

1. What is the skull made up of?

   ....

2. What encloses the skull?

   ....

3. What is the difference between the upper jaw and the lower jaw?

   ....

4. How are teeth fitted into the jaws?

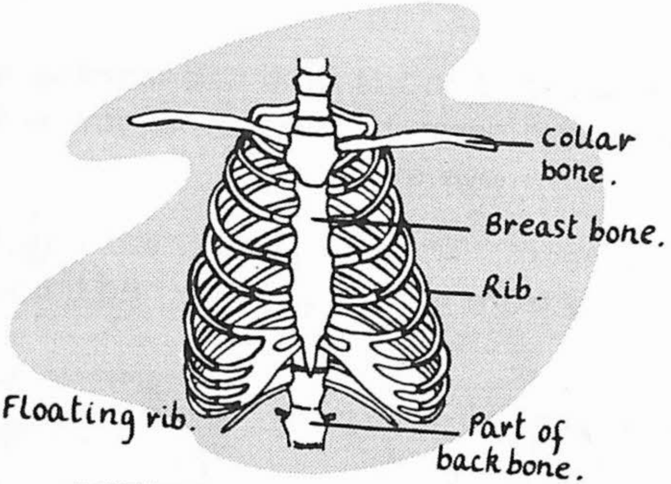
   ....

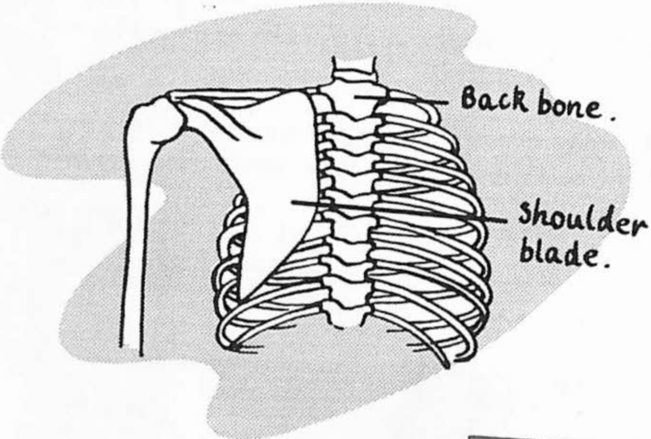
The chest box

The chest box is made up of **twelve pairs** of curved bones, which are called ribs. At the back they are joined to the backbone (Fig. 9), and at the front 10 pairs of ribs are joined to a stout dagger-shaped breastbone. The two pairs of ribs which are not long enough to join the breastbone are called **floating ribs.**

The back portion of the chest box has two big bones. These are flat and more or less triangular in shape. They are known as **shoulder blades.** The upper arm bones are joined to the shoulder blades.

The entire chesk box is covered by muscles. In the front are the **chest muscles** or **rib muscles** and in the back are the back muscles. All these muscles are flexible and can be stretched. This is important in breathing, as the rib muscles allow the chest box to expand and contract.





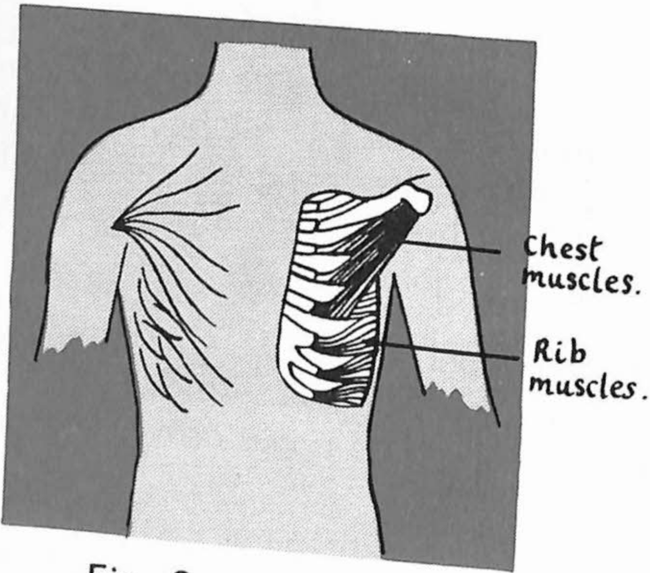


Fig. 9

Answer these questions:

1. How many pairs of ribs are there in the chest box?

....

2. What is the name of the
the front?

....

3. How many pairs of ribs are joined to it?

....

4. How many pairs of ribs are not joined to it?

....

5. What are these ribs called?

....

6. What is the name of the large flat bone that covers the back of the chest box?

....

Things to do:

Collect bones of animals that you can find. Bring them to school.

The backbone

In the lesson on the chest box you learnt that the ribs are joined to a part of the backbone.

The backbone is made up of a large number of small bones put together like a string of beans.

Each small piece of bone is called a **vertebra,** and in the backbone there are 33 of them. Passing through these vertebrae is a white thread-like thing called the **spinal cord.**

The vertebra is a small bone. It is irregular and has **spines.** A vertebra of the upper part of the backbone is different from that of the lower part, but they fit into each other in such a way that they can be moved about freely.

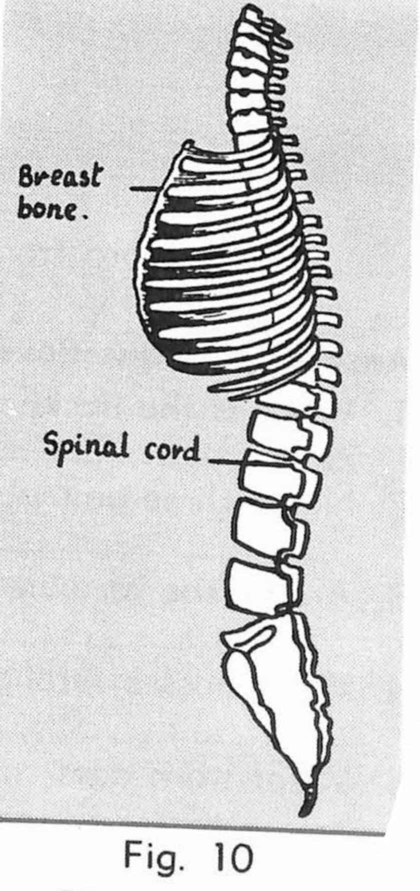


Fig. 10
The backbone

Each has a hole in the centre through which the **spinal cord** passes.

There are muscles which help to keep the vertebræ in their proper places.

In this way the vertebræ and the muscles that enclose them protect the delicate spinal cord from injury.

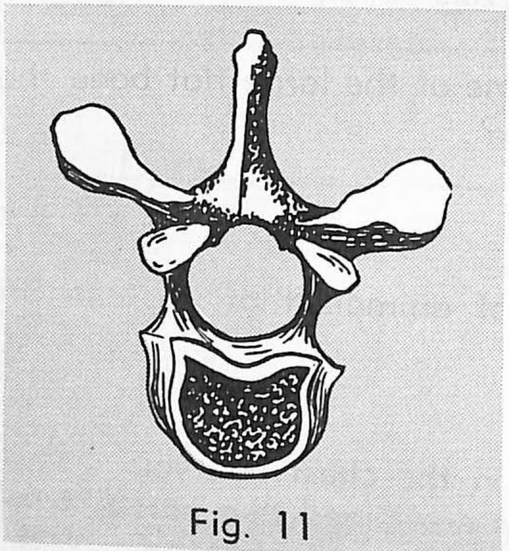


Fig. 11

A vertebra from the chest part of the backbone.

Answer these questions:

1. What is the backbone made up of?

....

2. Name three animals that have backbones.

....

3. Are all the vertebræ the same size and shape?

....

4. What passes through the backbone?

....

5. What work does the backbone do?

....

6. What is the shape of the first vertebra?

....

The hip bone

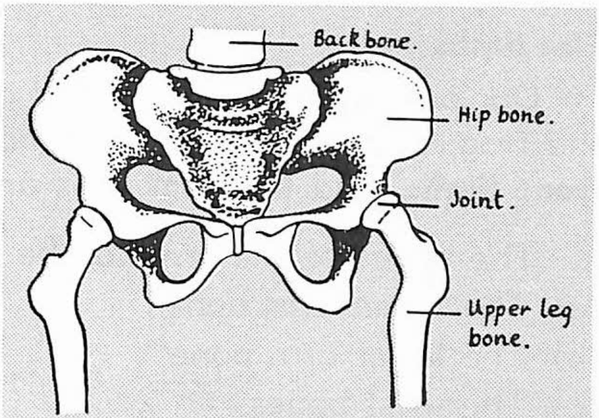


Fig. 12 The hip bone

This is the largest and heaviest bone of the skeleton. It has to be so because it supports the weight of the upper part of the body.

The backbone joins the hip bone at the top. At the sides are two large holes called sockets. The round head of the upper leg bone fits exactly into these sockets. This kind of joint is called the **ball and socket** joint.

Answer these questions:

1. Why must the hip bone be strong and heavy?

   ....

2. What are the holes at the sides of the hip bone called?

   ....

3. What are fitted into these?

   ....

4. How are the upper leg bones joined to the hip bone?

   ....

   Make a drawing of the hip bone here.

The limbs

Our arms and legs are called limbs. In the case of animals like the frog, rabbit, dog, cat and mouse, the front legs are called the **front limbs,** and the back legs are the **hind limbs.**

The bones of the arm can be divided into:

(a) The upper arm bone
(b) The lower arm bone
(c) The wrist bones
(d) The finger bones

The upper arm bone is a long one, and it is connected to the shoulder blade by a ball and socket joint. This joint enables the arm to rotate freely.

The upper arm bone is covered by two main sets of muscles, the **biceps** in the upper part and the **triceps** in the lower part.

The lower arm bone is made up of two bones. It is connected to the upper arm by a joint called a **hinge joint,** which can be bent in one direction only.

The wrist is made up of many small bones, so as to allow easy wavy movement. Wave your hand and see how easily it moves.

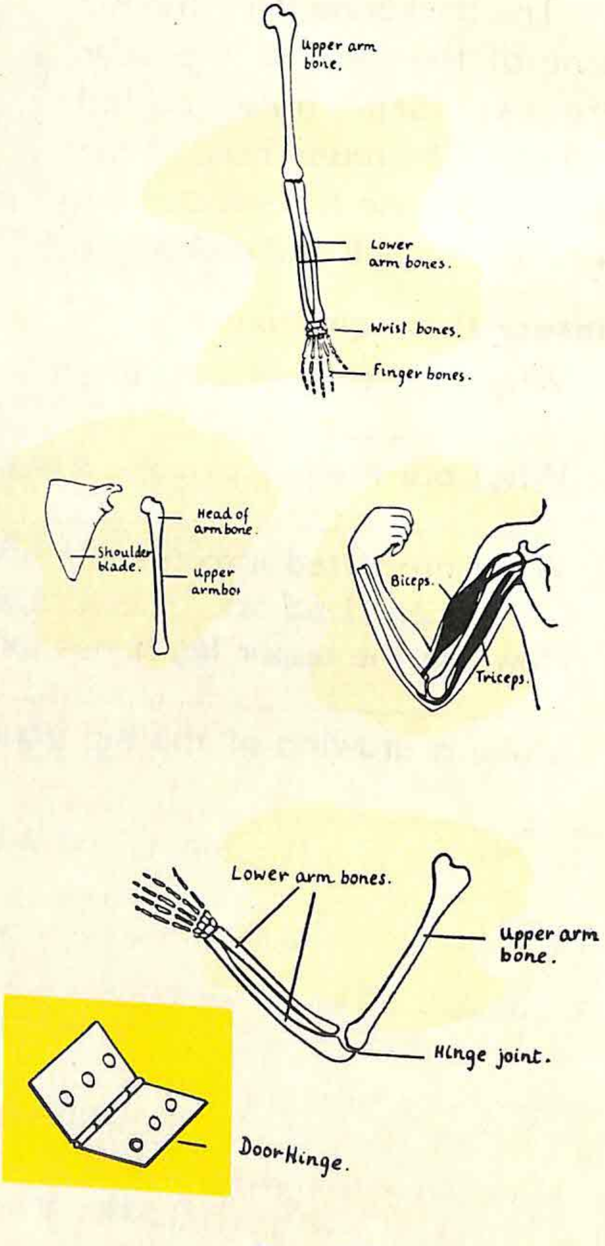


Fig. 13

Each finger has three hinge joints.

The lower limbs—legs

The thigh bone is a big long bone. The head is round and fits exactly into the socket of the hip bone; this is a ball and socket joint. The lower leg bone, like the lower arm bone, is made up of two bones.

The figure shows you how a bending movement can be made at the knee and the ankle, and a circular movement at the hip.

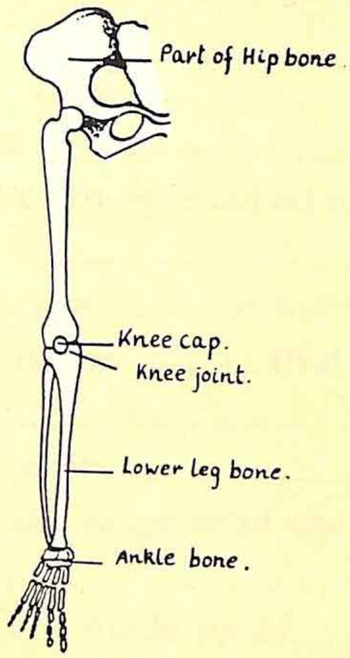


Fig. 14

Answer these questions:

1. What are the front legs of a frog called?

....

2. What are the back legs of a frog called?

....

3. Name the parts of the arm and leg bones in the dotted lines

Arm bone	Leg bone
a.	(i) ....
b.	(ii) ....
c.	(iii) ....
d.	(iv) ....

4. The upper arm bone is joined to the shoulder blade by a .... joint.

5. The joint between the thigh bone and the lower leg is called the .... which allows the limbs to move in ....

(one direction, several directions, circular movement).

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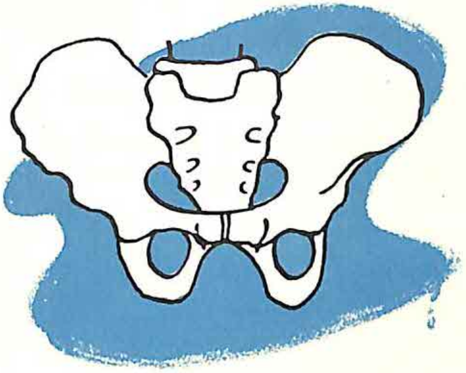
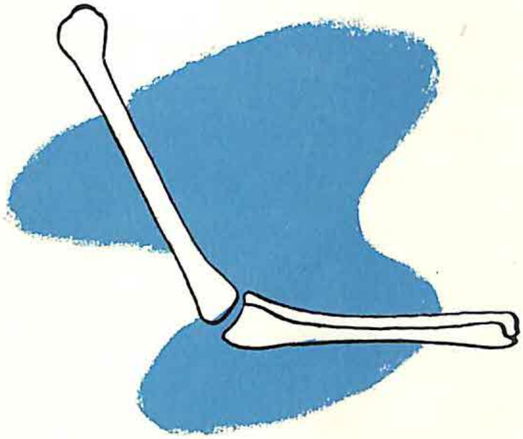
6 Draw a leg bone here.

Draw diagrams of bones you have studied.

Fill in the blanks with words supplied





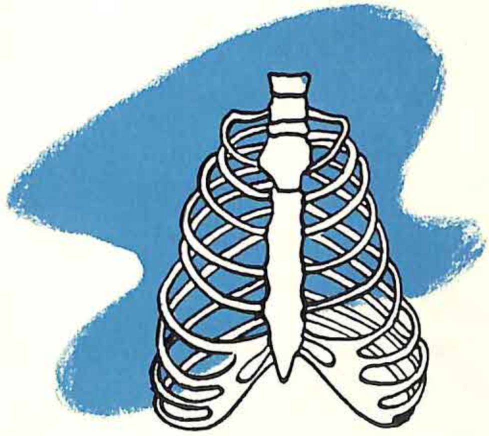


Fig. 15

This is the .... which protects the ....

Each of these is called a ....

....

There are .... of them in man.

This is the .... that supports the ....

This is the .... bone.

This is a diagram of the ....

....

which is made up of............................ and muscles.

The curved bones are joined to the .... bone in the front.

Its work is to protect (a) .... (b) ....

Helping words

Chest box
Skull
Heart
Lungs
Hinge
Rib

Vertebra
Breast
Lower arm bone
Lower leg bone
Digits
Hip bone

CHAPTER 3

FOOD, EATING AND DIGESTION

Fill in the columns given here to show the food you eat at breakfast, luncheon and dinner. Keep this record for five days.

DAYS	BREAKFAST	LUNCHEON	DINNER

The commonest type of food you eat is ....

From the list you have made now write down

a) Food that comes from plants

....

....

b) Food that comes from animals

....

....

c) Food that comes from neither animal nor plant

....

....

From your list you have found that most of our food comes from animals or plants. Animals, however, feed on plants. Thus indirectly we depend on plants for food. This is because only plants can make food from sunlight, air and water.

For example

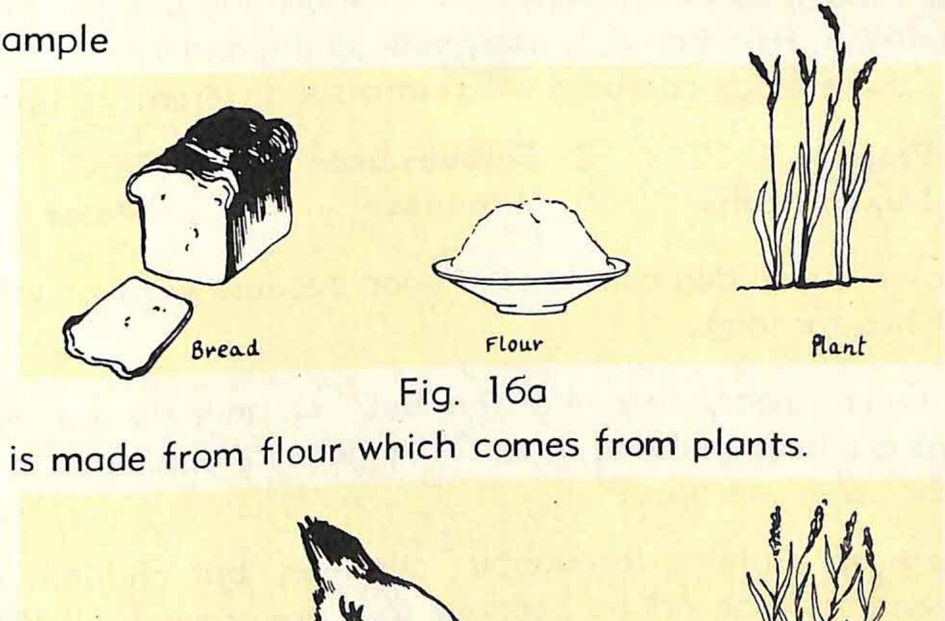


Fig. 16a

Bread is made from flour which comes from plants.

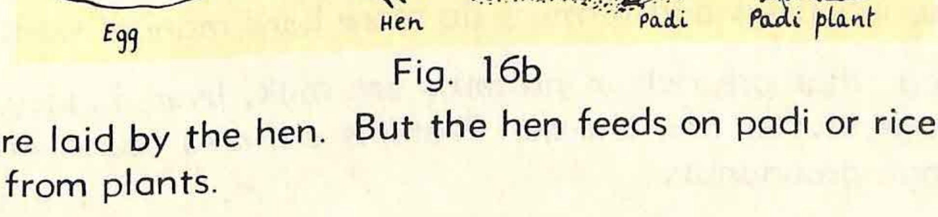


Fig. 16b

Eggs are laid by the hen. But the hen feeds on padi or rice which comes from plants.

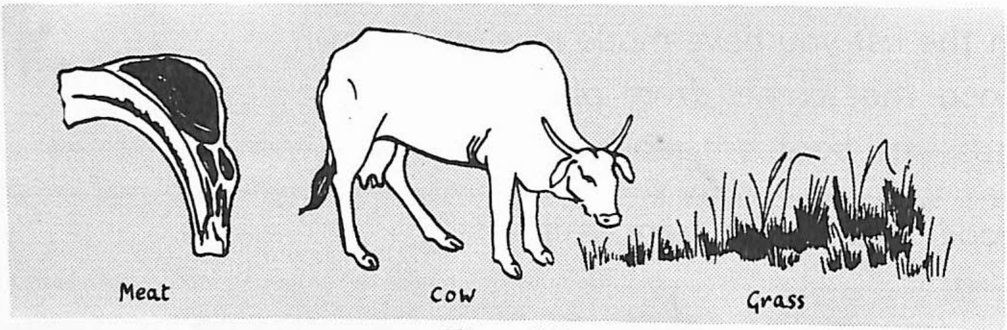


Fig. 17

The meat that is served at table comes from animals that feed on grass.

Hence we say that all living things on earth depend directly or indirectly on plants for food. It is important then that we have plants around us.

Our food is obtained from both animals and plants. We have beef, mutton, fish, bread, butter, milk, chilli, and vegetables of all kinds. These foods can be divided into six different groups:–

1. **Protein**
2. **Carbohydrate**
3. **Fats**
4. **Mineral salts**
5. **Vitamins**
6. **Water**

Water is included as a kind of food because without water we cannot live for long.

Proteins: meat, fish and the flesh of animals are proteins. Proteins are **body-building food.** They help to replace parts of the body that are "worn out".

We need proteins throughout our lives, but children require more proteins than adults because they are growing all the time. Those who do manual work, such as labourers and farmers, need more proteins and carbohydrates than those who work in an office because labourers and farmers do more hard manual work.

Foods that are rich in proteins are milk, liver, kidney, meat, fish, eggs, butter and cheese. Proteins are also found in beans, peas, and groundnuts.

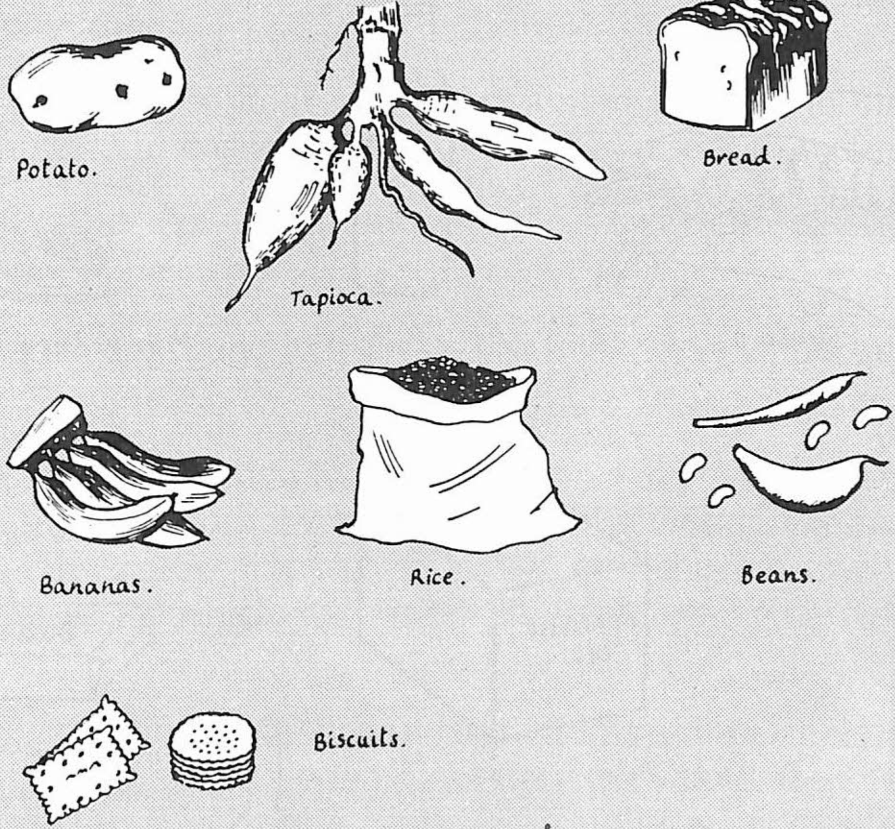


Fig. 18

These contain carbohydrates and give us energy.

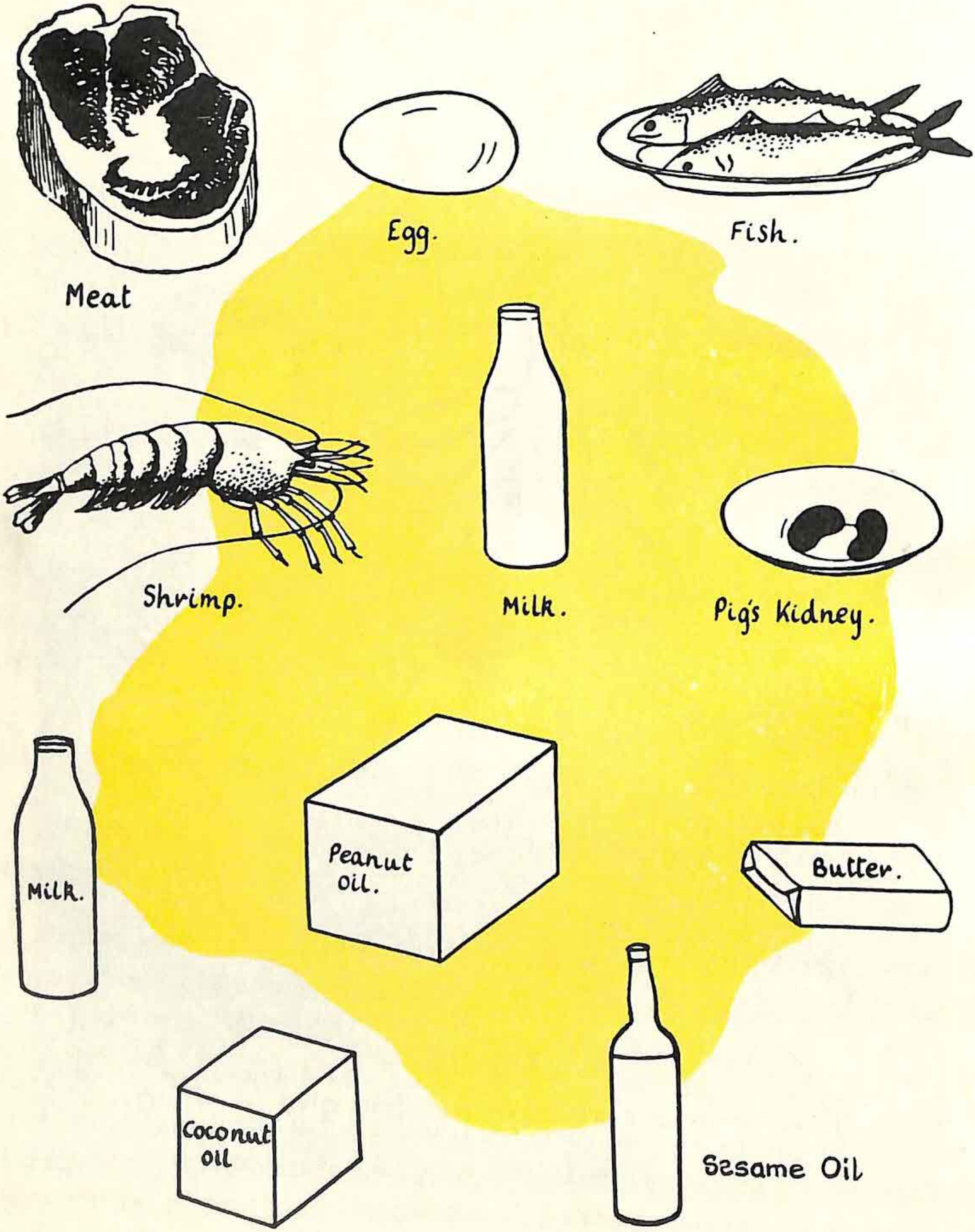


Fig. 19

These come from animals and plants.
They give heat and energy.

Carbohydrates: These are **heat** and **energy producing foods.** Therefore carbohydrate foods give us a lot of energy and enable us to do hard manual work.

The main meals (i.e. rice) that we eat contain mostly carbohydrates. Other foods that contain carbohydrates are potato, bread, maize and grains such as peas and beans. Turnips, pumpkins, sugar cane, milk and bananas contain a large amount of carbohydrates.

Fats: Fats produce heat. They are found in cooking oil, butter, groundnuts, and cashew nuts. Coconut is also rich in fats.

Minerals: Our bones are made up of two important minerals, calcium and phosphorus.

Minerals are found in most of the foods we eat, particularly in fruit and vegetables.

Vitamins: Not long ago scientists discovered that other things as well as proteins, carbohydrates, fats and minerals were needed to make the body grow properly. Our food must have a small amount of the vitamins which are found in fruit, raw vegetables, milk and eggs.

It has also been discovered that vitamins are protective foods. A person whose food contains no vitamins would soon fall ill.

There are different types of vitamins. There are vitamin A vitamin B, vitamin C, vitamin D, vitamin E, and many others.

At one time sailors who were at sea for a long time without fresh vegetables or fruit were found to be suffering from a disease called **scurvy.** This is caused by the lack of food containing vitamin C.

However, the foods we eat, particularly fruit, eggs, butter and milk, contain vitamins.

Lack of	Diseases caused
Vitamin A	Night-blindness–cannot see well in poor light.
Vitamin B	Beri-beri–affecting the nerves
Vitamin C	Scurvy–affecting the blood
Vitamin D	Rickets–bones and teeth not hardened

Here are the common sources of the various types of vitamins:

Vitamin A–Cod-liver oil, eggs, milk, cream and liver.

Vitamin B–Unpolished rice, cereals and nuts.

Vitamin C–Fruit and fresh vegetables.

Vitamin D–Same as vitamin A.

Water

Water is very important to the body because about 80 per cent of our body is made up of water. Our body gives off plenty of water when we sweat, when we breathe, and when we pass urine. To make up for this water lost, we must drink plenty of water every day.

Things to do:

1. Test for carbohydrate: cut open a potato. Put a drop or two of iodine on it.

What happens?

Yes, the potato turns bluish black. This is because it contains starch, which is a carbohydrate. Starch makes iodine change its colour.

2. **Test for oil:** Rub peanut butter on a piece of paper. Hold the paper up to the light. Is it greasy? .... This shows that the nut contains oil.

EXERCISE: Go to the market and find out the price of various kinds of food and fill in the columns below:–

Kind of food	Price per kilo	

Revision exercises

1. Starch is a kind of .... (protein, carbohydrate, iron).
2. An example of food that contains starch is .... (orange, banana, beef).
3. An important mineral for the making of bones is .... (calcium, chlorine, iron, aluminium).
4. The lean meat of an animal is actually made up of .... (protein, vitamin, minerals).
5. A clerk needs .... (more, less, the same) amount of protein than a labourer.
6. Iodine is used to test .... (protein, vitamin, carbohydrate).

7. We need .... (a large amount, a small amount, any amount) of vitamins .... (every day, once a month, once a year).
8. Our body is composed of about .... per cent of water (6, 50, 80).
9. Kidney is particularly rich in .... (vitamin, iron, protein).
10. Lack of vitamin B causes .... (typhoid, beri beri, tuberculosis).
11. The lack of vitamin C causes a sickness called .... (leprosy, scurvy, indigestion).
12. Fill the spaces with the correct words; clues are given below.

1 C	A	R		O			D			T	E
2 M		L		■	■	3 W			E	R	■
■	4 V	I		A				S	■	■	■
5 P	R		T				■	6 S			T
7 C		L	C			M	■	8			

Clues:

1. Heat and energy producing food.
2. A wholesome food.
3. About 80% of it makes up our body.
4. Without these the body cannot grow properly.
5. Body building food.
6. This makes our food tasty.
7. To have strong bones and teeth we need this mineral.
8. Our blood contains this mineral.

The food tube

When you eat, food is gradually broken up and finally becomes **liquid food.** This is done by the parts of the body which are part of the **food tube.** The food tube starts from the mouth and ends at the anus (see figure below.)

When the food is chewed it passes into a tube which leads into an elastic bag called the stomach. It then passes into several feet of narrow tubes called the **small intestines,** which occupy a large part of the "belly". From here it passes into larger tubes called **large intestines** which surround the many coils of small intestines.

When food has passed through the food tube (stomach, small and big intestines) some of it is changed into liquid food. This way of changing solid food into liquid food which can be absorbed into the blood is called **digestion**. The waste solid matter that is left is excreted from the anus.

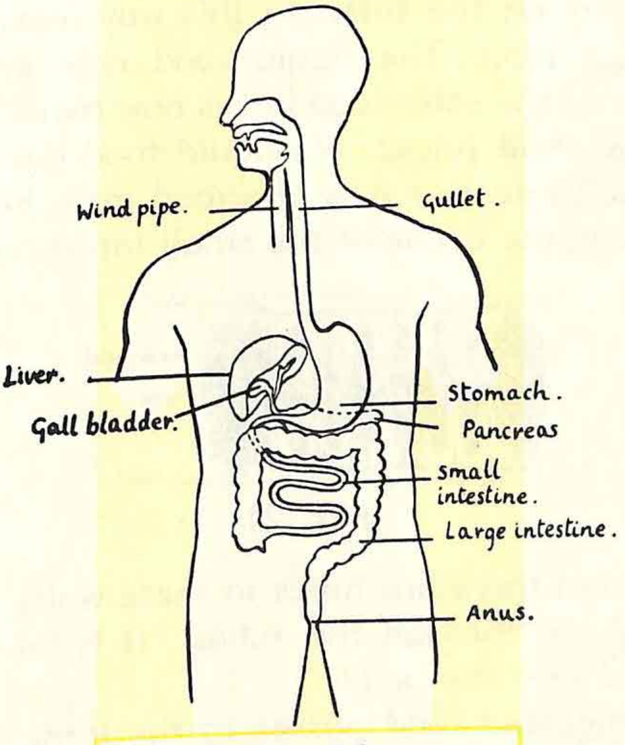


Fig. 20
The food tube.

Eating and digestion

Before food can be of use to the body it must be changed into liquid form. This is done by the food tube.

Digestion begins in the mouth. Here the food is chewed, and crushed into small bits. During this process, **saliva** is mixed with the food, making it semi-liquid. Saliva is important to food digestion because it contains **food juice.** This particular food juice break up the insoluble (complex) carbohydrates like starch into simple (soluble) forms like sugar, which is immediately taken into the body. When food is swallowed it enters the gullet. Food is prevented from entering the windpipe by the **epiglottis.**

The stomach begins to work as soon as food enters it. The muscles begin to contract and expand, pressing the food and making it into liquid food. The stomach pours out three different kinds of **food juices.** One breaks up the **carbohydrates** that have not been broken by the saliva, the second breaks up the proteins, and the third acts on the **fats.** In this way most of the food is made into liquid food. The liquid food now enters the small intestine. Some of the solid food left is now made into liquid food by the **intestinal food juices.** As liquid food passes through the walls of the small intestine it is absorbed into the body. Here is a drawing to show the inside of the small intestine.

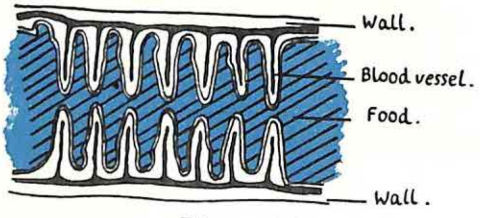


Fig. 21

You notice that there are tubes in these walls. A fine network of blood vessels run through the tubes. It is these blood vessels that absorb food into the body.

A little undigested food passes to the large intestine and is absorbed, together with a large quantity of water. The solid that passes out of the anus is **waste matter** or **faeces.**

Indigestion. Some foods such as maize and white of egg are n easily digested. If the food tube contains too much of such food the body will not work properly. The person may become sick with **indigestion.**

There are other organs which help the digestion. These are the liver and the pancreas.

The liver is dark red in colour and gives out a greenish liquid called **bile.** Bile enters the food tube near the beginning of the small intestine and helps the digestion of fats. The liquid from the pancreas helps the digestion of all these kinds of food—proteins, carbohydrates and fats.

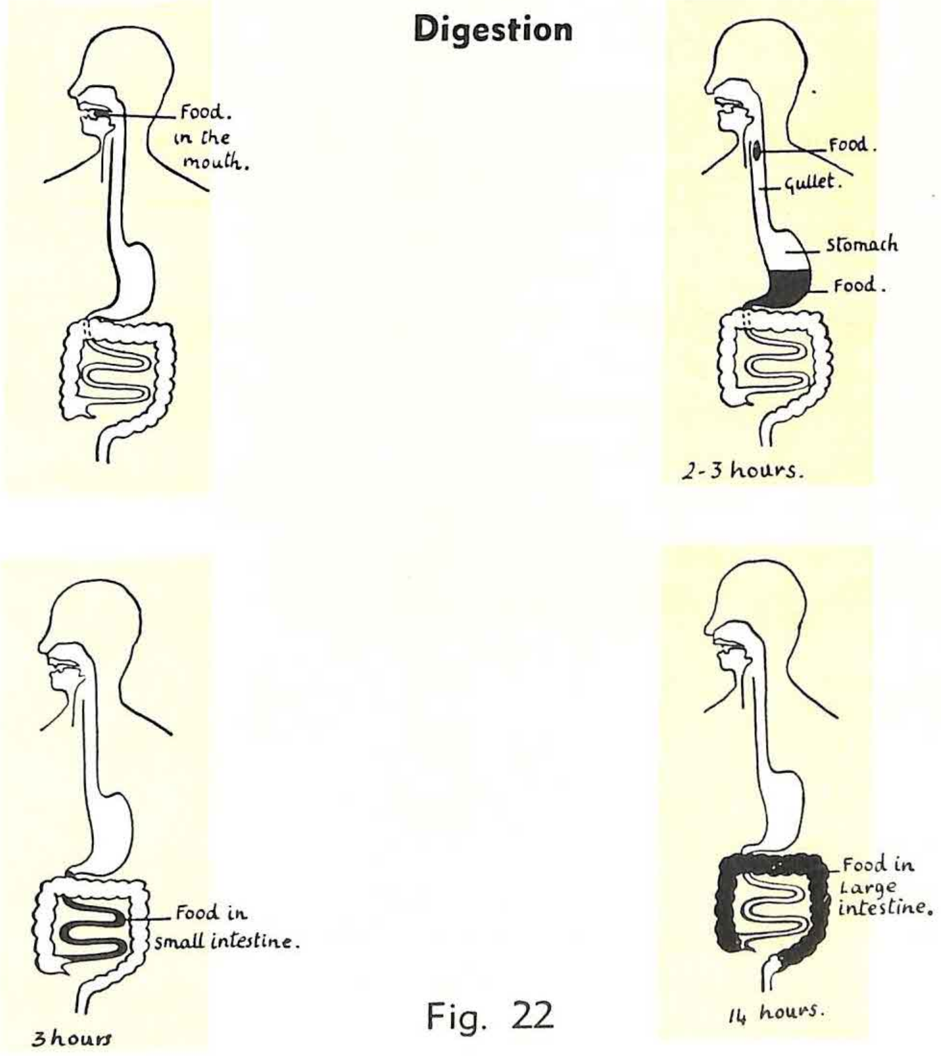

Digestion

Fig. 22

Answer these questions:

1. What parts of the body actually make up the food tube?

....

2. What stops food from entering the windpipe?

....

3. Why do we need to have a long and a small intestine?

....

4. Where does the undigested food go before it is passed out?

....

5. What is added to food in the mouth?

....

6. What happens to some of the carbohydrates in the mouth?

....

7. What is added to food in the stomach?

....

8. Where does the last part of digestion take place?

....

9. How is digested food taken into the body?

....

10. What is added to food in the small intestine?

....

11. What other organs help digestion?

....

12. What is the special way the liver helps digestion?

....

13. Draw a diagram to show the food tube.

Things to do:

(Teacher will dissect a frog or toad to show you the inside parts.)

Here is a drawing of a frog which has been cut open. Try to name the parts.

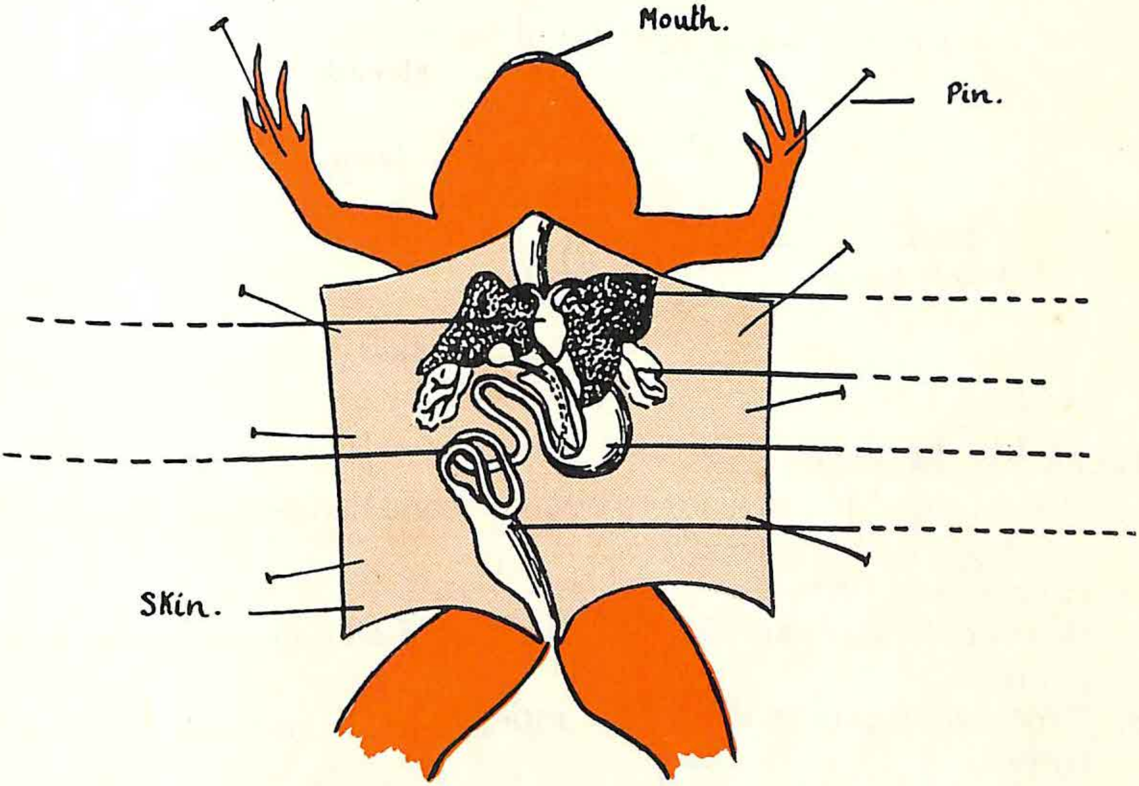


Fig. 23

Here is a drawing to show the inside of a man. Compare this with the drawing of a frog.

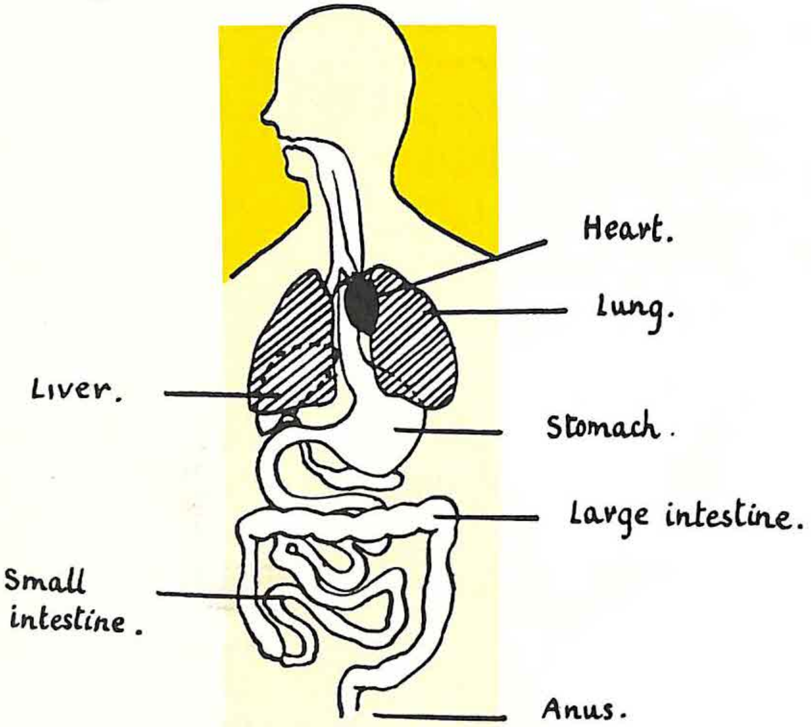


Fig. 24

Topics for discussion

1. Mohan says "If you want to be strong and healthy you should eat only body-building food".
   Is he right? Why?
2. How would you explain that the food of all animals comes from plants?
3. "You will become sick with indigestion if you eat too much fruit."
   Is this statement true? Why?
4. Can you explain why a farmer needs more body-building food than an office worker?
5. Tell your class of your visit to a dentist.
6. If you have good teeth you enjoy your food better.
   How far is this true?
7. Aunty said that eating too many sweets and cakes is bad for the teeth.
   Do you think that she is right?

CHAPTER 4

TEETH

Man has two sets of teeth. The first set is composed of 20 teeth which are called the **"milk teeth".** A child begins to get his first tooth when he is six to eight months old. As he grows, more teeth appear until he has 20 teeth. As the child grows older these teeth drop out. In their place bigger and stronger teeth appear. These are called **permanent teeth.** These permanent teeth are not replaced if they decay and are pulled out.

There are the following teeth in each jaw:–

4 incisors
2 canines
4 pre-molars
6 molars
—
16
—

Hence the permanent set is made up of 32 teeth, 16 in the upper jaw and 16 in the lower jaw.

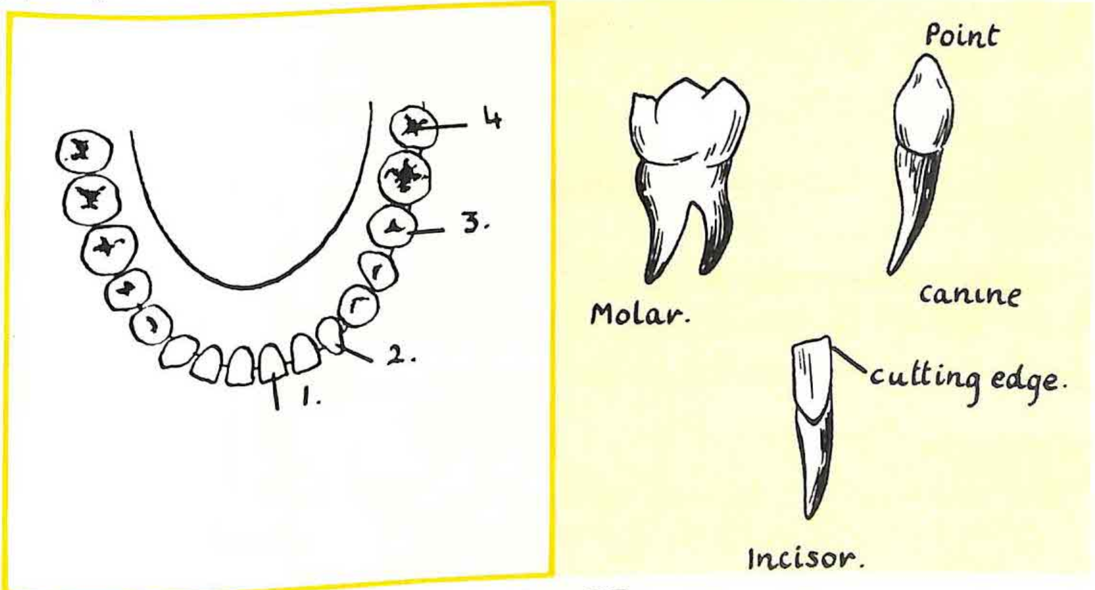


Fig. 25

A set of teeth in the lower jaw

Nos. 1 and 2 are the front teeth and Nos. 3 and 4 are the **back teeth.** Each has a name. No. 1 is the **incisor,** No. 2 the **canine,** No. 3 the **pre-molar** and No. 4 the **molar.**

Answer these questions:

1. How many teeth are there in the upper jaw? ....
2. How many are there in the lower jaw? ....
3. How many teeth have you altogether? ....
4. Look at the diagrams below.
5. Fill in the names of the teeth in the diagram below

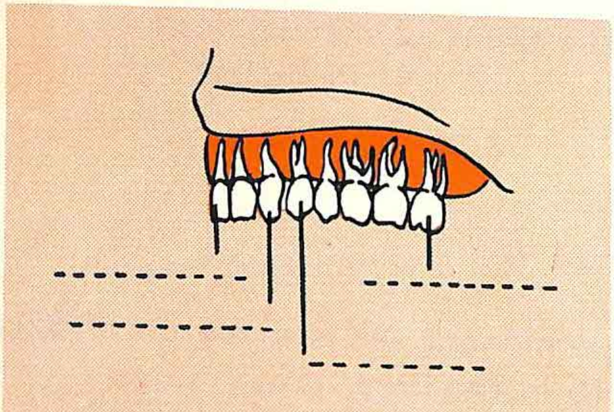


Fig. 26

The incisors

These are the front teeth. They have sharp cutting edges use for biting. The upper part of the incisors is broad and the lower part narrow, so when two incisors are together there is a space between them.

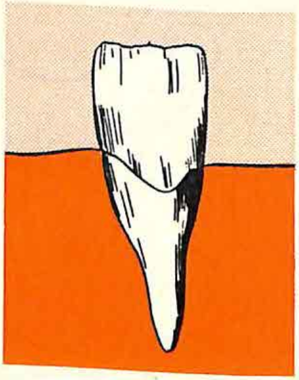


Fig. 27a

The canines

The canines are pointed so that they are suitable for tearing flesh or meat from bones. They are smaller than the incisors.

Man has only two canine teeth in each jaw, but some animals—for example, the dog and the fox—which feed on the flesh of other animals, have more.

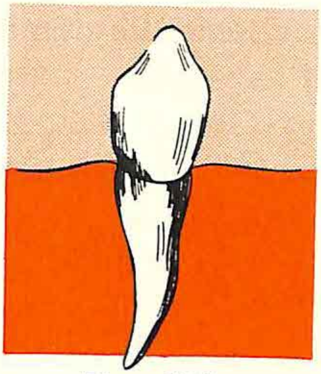


Fig. 27b

The pre-molars are larger than the incisors or canines. The covering is not smooth but has grooves and cusps. The surfaces are flat. When you close your mouth the surface of pre-molars and molars fit nicely into each other, making them very suitable for grinding and crushing food.

Pre-molars and molars usually have more than one root, sometimes two and sometimes three.

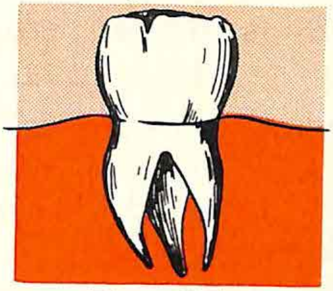


Fig. 27c

ABOUT YOUR TEETH

Things to get: A guava or an apple, and a small mirror.

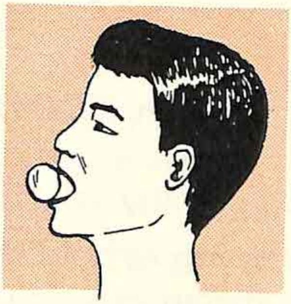


Fig. 28

1. Bite the fruit.
   Which teeth do you use, the front or the back? ....
2. Chew the piece of fruit slowly.
   Which teeth do you use now? ....
   ....
3. When you have finished chewing look at your mouth in the mirror.
   Are there any pieces of fruit sticking to the spaces in the teeth? ....
   Look at the front teeth. Are the edges flat and sharp? ....
   ....
   Look at the back teeth. Are these bigger than the front teeth?
   ....
   Are the edges flat? ....
   Are there any grooves on the surfaces? ....

4. Count the number of teeth you have in the upper jaw and the lower jaw.

....

5. When does a child begin to have his first tooth?

....

6. Which teeth appear first?

....

7. What do we call the first set of teeth?

....

8. Is this set permanent?

....

9. How many teeth are there in the first set?

....

10. How old will the child be when his first set is complete?

....

11. A full set of permanent teeth has a total of .... teeth. It has .... incisors, ... canines, ... pre-molars and .... molars.

A TOOTH

Each tooth sits in a socket in the **jaw bone.** Helping to hold the tooth in a strong position is a layer of **cement.**

The outer layer is covered by **enamel.** This layer is very hard and does not crack easily. The second layer is made of a white substance called **dentine.** Unlike the enamel, dentine is easily attacked by germs if the outer covering decays.

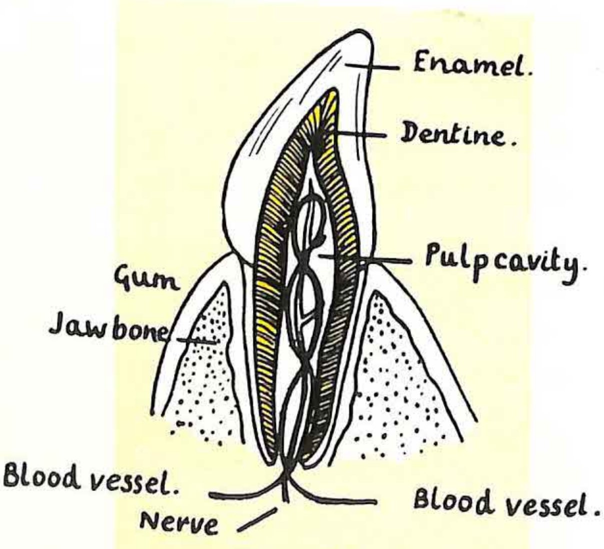


Fig. 29

In the centre of the tooth is a hole called the **pulp cavity** which has an opening at the base. A **blood-vessel** enters the cavity to supply food for the tooth. Also within the cavity is a nerve. It is this nerve which gives you toothache when a tooth decays.

Answer these questions:

1. A tooth fits into a hole in the jaw called the ....
2. How is a tooth held firmly?

   ....
3. How many layers are there in a tooth?

   ....
4. Which is the harder layer, the inner or the outer?

   ....
5. What is the name of the outer layer?

   ....
6. What is the name of the inner layer?

   ....
7. What is the name of the space in the tooth?

   ....
8. What are present within this space?

   ....
9. What does the blood-vessel do?

   ....
10. What happens when the outer layer of a tooth is spoilt?

    ....

Why must you brush your teeth?

Teeth are arranged in such a way that there are spaces between them. When you eat, small pieces of food remain in the spaces. If these pieces of food are not removed by brushing they go bad. When food goes bad, germs feed on it. Slowly these germs will begin to attack the teeth too. If this goes on, a hole appears in the bad tooth! Then you have to see the dentist immediately; otherwise the germs go deeper and deeper until they reach the dentine and pulp cavity, and the nerve. When this happens you will have a terrible toothache. Then it may be too late for the dentist to fill up the hole; you may lose the tooth. If you lose a tooth you will not be able to chew your food properly.

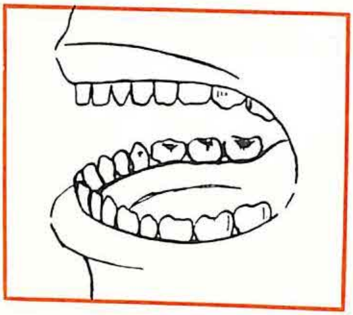


Fig. 30

Can you see the spaces between the teeth?

See what happens to a tooth that is going bad.

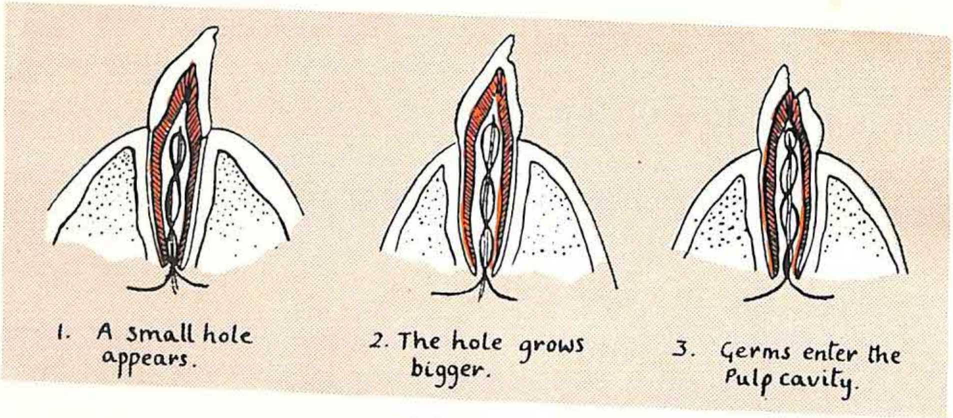


Fig. 31

Can you prevent this happening? Of course you can.

There are two ways to prevent teeth decaying. **Firstly,** you should brush your teeth regularly, especially after a meal or after eating sweets. **Secondly,** you should visit the dentist at least once a year.

How to brush your teeth

Your tooth brush must be of the type that is suitable for the size of your teeth. The "hairs" must not be too stiff or too soft.

CHAPTER 5

BREATHING

EXERCISE 1

Stand up with your hands by your sides. Breathe in. Breathe in very deeply a few times. Do you feel your chest become bigger when you breathe in?

This time take in a deep breath, and as you breathe out slowly count 1, 2, 3, 4, 5, 6, 7, 8 .... Repeat this. How many counts does it take to let the air out of your chest?

EXERCISE 2

To measure the size of your chest with a piece of string.

Ask your classmate to measure the size of your chest when you breathe out and when you breathe in. Write your answers here.

The size of my chest when I breathe out is........................centimeters.

The size of my chest when I breathe in deeply is............centimeters.

When you breathe, air is forced out of your lungs and fresh air enters to take its place. The air that you breathe out is called **expired air.** This taking-in and giving-out of air is a continous thing. It goes on all the time. Air enters the nose and goes down the windpipe and into the lungs. The windpipe is kept open by a special kind of muscle called the **cartilage,** which is quite soft and yet stiff. Near the collarbone the windpipe divides into two tubes; each goes into a lung.

The lungs are fairly large organs which occupy practically the entire chest box. They are actually made up of a large number of tiny bags called **air sacs.** Fresh air that enters the lungs goes immediately into these air sacs.

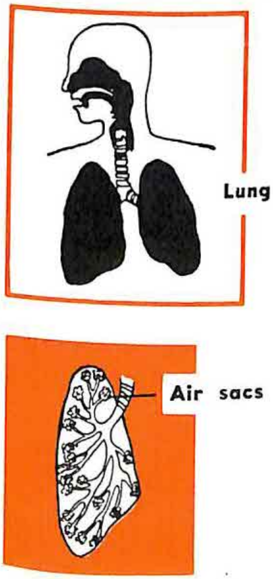


Fig. 32

Covering the lungs are blood vessels. These blood vessels take in oxygen from the fresh air and give out carbon dioxide to the expired air.

The nose

The presence of **fine hair** and a sticky liquid substance called **mucus** in the nose helps to trap and remove any dirt and germs from the air breathed in. In this manner the air that finally reaches the lungs is clean.

The reason why we must not breathe through the mouth is because the mouth has no means of removing the dust and dirt before the air enters the lungs.

The lungs

When you take in a deep breath many things happen: the chest muscles are stretched, the ribs are raised forward and upward, the diaphragm is pushed down so that the volume of air taken in can be bigger. But as you breathe out the opposite things happen: the chest muscles contract, the ribs return to their normal position, the diaphragm is curled upwards, helping to force the expired air out of the lungs.

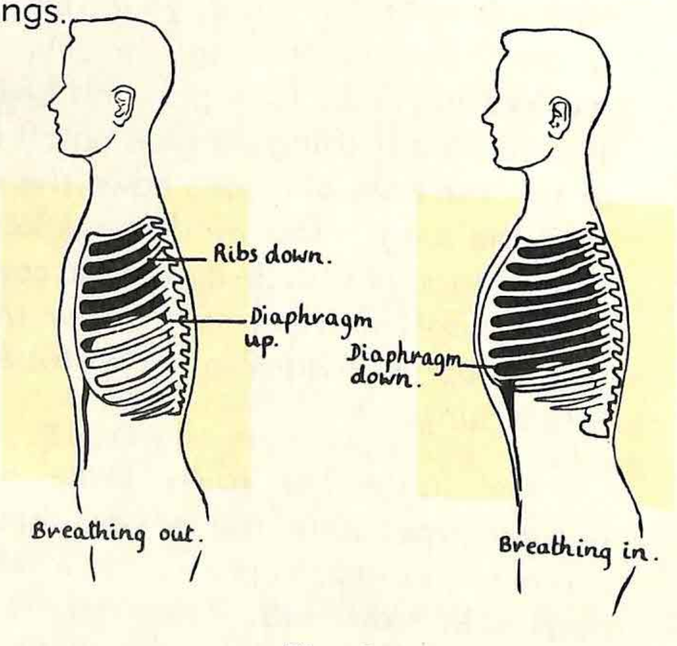


Fig. 33a

As you breathe there is a regular flow of air in and out of the lungs. Air containing oxygen enters the lungs and air sacs, where the blood takes in oxygen. At the same time the blood gives out carbon dioxide which is forced out through the lungs, windpipe and nose.

EXERCISES

1. The organs for breathing are ....

   ....

2. The windpipe is kept open by ....

   ....

3. Where does the air go after entering the lungs?

   ....

4. What protects the lungs?

   ....

5. What happens to the oxygen that you breathe in?

   ....

6. Where is carbon dioxide given out by the body?

   ....

7. How is air made clean before it enters the lungs?

   ....

BODY WASTE

As an animal eats, it grows. Food that is digested is taken into the body. Food that is not digested is passed out of the body at intervals as body waste or faeces.

Faeces are usually solids that are of no use to the body. In addition liquids are excreted by the skin and kidneys and gases by the lungs. This getting rid of body waste is called **excretion.**

Excreting is just as important a process as eating or breathing. If undigested food is not excreted its presence in the body makes the person ill. This is because body waste produces poisons. Hence for the body to work properly, getting rid of body waste is important.

The kidneys

Urine is taken from the body by the kidneys.

The kidneys are found one on each side of the spinal column below the chest box. They extract waste matter from the blood

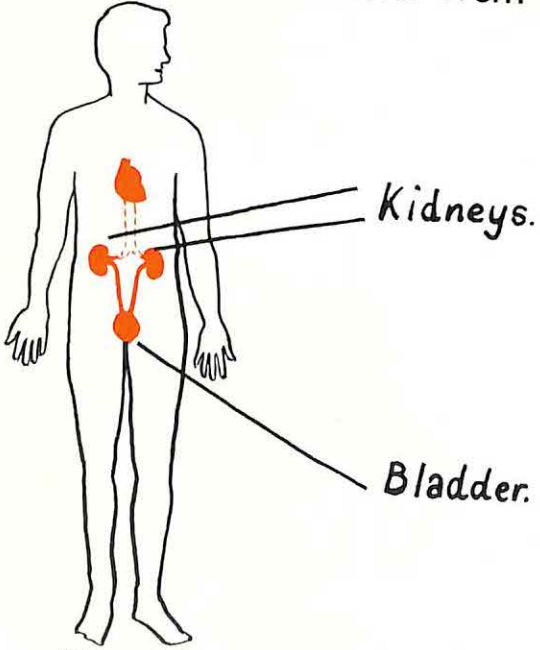


Fig. 34

and this passes as urine down tubes from the kidneys into the **bladder.** The bladder stores the urine until it is passed out.

The sweat glands

The body also gets rid of liquid waste in the form of **sweat.**

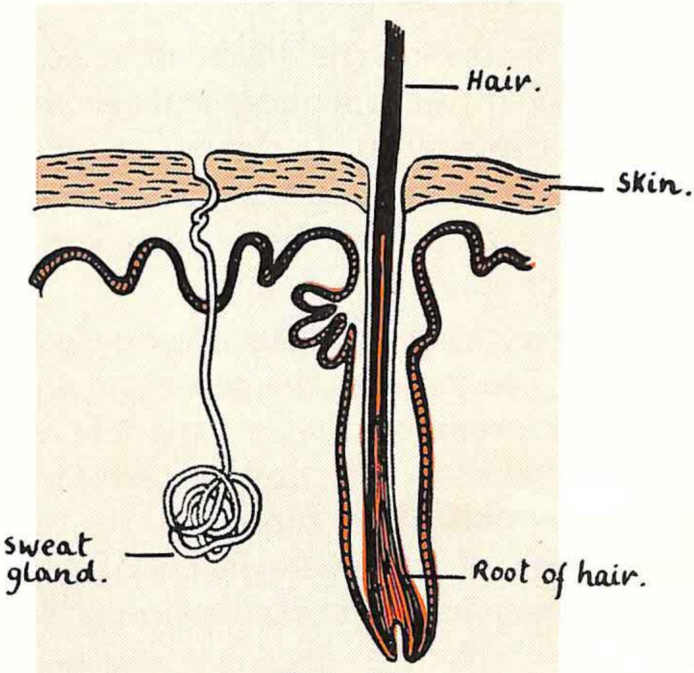


Fig. 35

The diagram on the right shows the inside of the skin. On the surface of the skin are many hairs. The hairs keep an animal warm. There are also many tiny holes in the skin. These are called **sweat pores.**

These pass through tubes into **sweat glands** in the skin which give out sweat.

Sweat is a body waste. It comes to the surface of the skin through the sweat pores. When sweat evaporates it helps to keep the body cool. When we breathe, we give out carbon dioxide and water vapour. These are also body waste and are another form of excretion.

Draw diagrams of (a) lungs and (b) kidneys here.

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THE HEART, BLOOD AND CIRCULATION

The heart

The heart-beat and the pulse are caused by the pumping of the heart.

The heart has the shape of a pear. It is broad at the upper part and becomes pointed near the tip. It slants slightly to the left. It is safely enclosed in the chest box. The size of your heart is as big as the size of your fist.

The heart is made up of strong elastic muscles. The inside of the heart is divided into **four chambers,** two on the left and two on the right, separated by a **muscular wall.** The blood on the left cannot mix with the blood on the right. The upper chambers are separated from the lower chambers by "one-way doors" called **valves** which allow blood to flow from the upper chamber to the lower but not from the lower to the upper. The lower chambers have much thicker walls than the upper ones.

There are four openings, one in each chamber. Blood enters the heart through the openings in the upper chambers, passes through the valve into the lower chambers and is pumped out through the openings in the lower chambers.

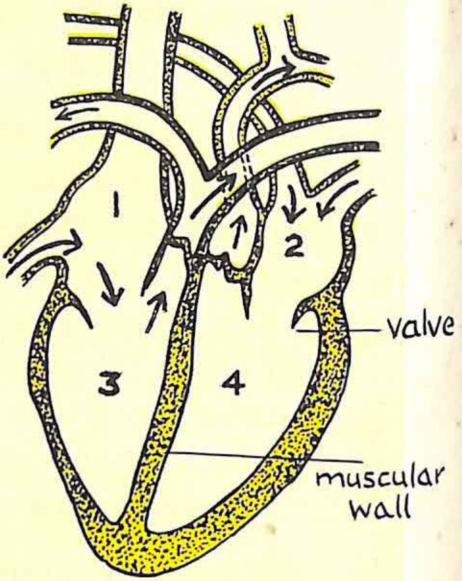
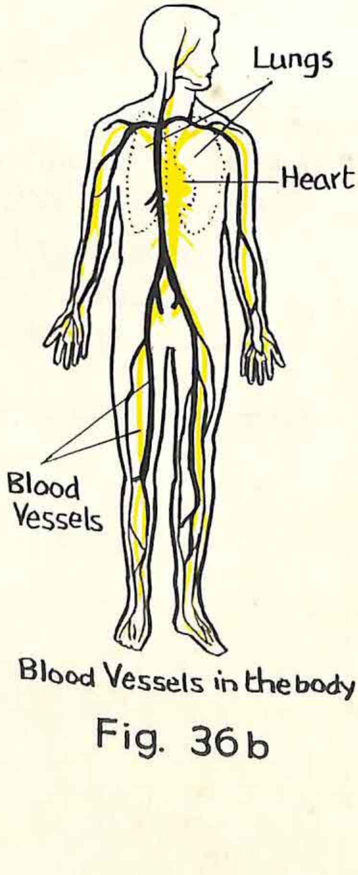


Fig. 36a



Blood Vessels in the body

Fig. 36b

EXPERIMENT 1

Put your ear to the left hand side of your classmate's chest. Can you hear his heart beat? ………… Use a stop-watch and time the number of heart-beats in one minute. Now allow him to time your heart-beat and write the answers below.

My heart beats ………………………… times in a minute.

Now make a little calculation.

In 1 minute my heart beats ……………………………………… times

In 1 hour ……………………………………… times

In 24 hours ……………………………………… times and in

1 year my heart beats ……………………………………… times

EXPERIMENT 2

Place the right fingers of your hand over the inner part of your wrist and feel your pulse. Use a stop watch and time the number of beats in one minute.

In 1 minute my pulse beats ……………………………………… times

Is this answer the same as your heart-beat? ………………………………

Answer these questions:

1. What is the heart for?

………………………………………………………………………………………………

2. How many chambers has the heart?

………………………………………………………………………………………………

3. Which are the actual pumping chambers?

………………………………………………………………………………………………

4. Which chambers have thick walls? Why?

………………………………………………………………………………………………

5. What is the work of the valve?

………………………………………………………………………………………………

6. What is the rate of your heart-beat?

………………………………………………………………………………………………

7. What kind of blood do the arteries carry?

………………………………………………………………………………………………

What is blood?

Our blood is made up of a liquid which contains many tiny things called **corpuscles.** Corpuscles are of two types, red and white.

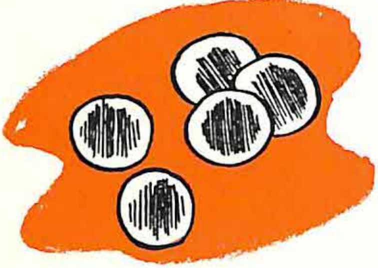


Fig. 37

The red corpuscles look like a pile of coins; each has a depression at its centre.

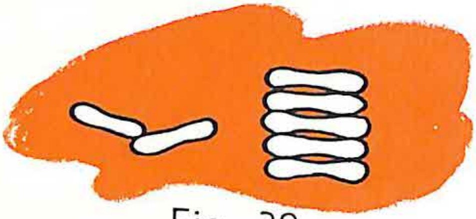


Fig. 38

The white corpuscles are in patches and are covered by jelly.

The red corpuscles carry oxygen and food; the white ones are able to fight germs that enter the body.

Blood is carried round the body by **blood-vessels.** There are three types of blood-vessel. Blood that is pumped through the main tube of the heart travels in **arteries** which have fairly thick walls. Tubes that return the blood to the heart have thin walls and are called **veins.** Blood is also carried by very thin tubes called **capillaries.** For example, the blood supplied to the tips of the fingers passes through many small capillaries.

1. What is blood made up of?
2. What can red corpuscles do?
3. What do red corpuscles look like?
4. What can white corpuscles do?
5. What do white corpuscles look like?

6. How is blood carried round the body?

....

7. Why do arteries have thick walls?

....

The pumping of the heart and blood circulation

As the heart contracts, the blood in the lower chambers is forced through the openings to arteries. One brings blood to the lower part of the body and the other takes blood to the lungs so that it can receive fresh oxygen. The artery that flows to the lower part of the body supplies blood to the stomach, the intestines, and the limbs.

As the heart relaxes, the blood from the upper chambers passes into the lower chambers.

The blood vessels that carry blood **away** from the heart are the **arteries.** The blood vessels that **return** blood to the heart are the **veins.**

What does the blood do?

The blood does many kinds of work.

1. The blood in the lungs takes in oxygen and gives out carbon dioxide. The blood that contains oxygen enters the upper left chamber and is pumped out from the lower left chamber to other parts of the body to give them oxygen.
2. The blood takes carbon dioxide from other parts of the body, such as the stomach and intestines, and returns it to the upper right chamber of the heart. It is then pumped from the lower right chamber to the lungs.
3. The white corpuscles in the blood can fight germs. Whenever germs enter the body through a cut or a sore, the white corpuscles encircle and kill them. Sometimes these corpuscles are not strong enough. In such cases the germs defeat the white corpuscles and more germs appear. These germs give off poisons which make you ill.
4. Blood takes in digested food from the walls of the small intestine, and goes round the body to give food to other organs.

CHAPTER 8

PARASITES

We know that some plants like the **pigeon orchid** get their food from other plants. Such plants are called plant **parasites.**

In this chapter we are going to study some small animals that feed on the food of other animals. Such animals are called **animal parasites.** An animal on which the parasite preys is referred to as a **host.** For example, a bed-bug feeds on the blood of a man; the bug is an animal parasite while the man is a host.

An animal parasite is a very much smaller animal than the host. In order that it can feed on the food of the host it has a special kind of jaw or mouth, and other special organs. These special organs help the parasite to cling very firmly to the host. The host is always on the losing side as its food is often taken by the parasite. If it loses too much food, the host becomes ill. Hence parasites are the cause of many diseases. Some small animals live in the body of another animal, but do not feed on its food. They are therefore not parasites.

There are two types of animal parasites. The first type is called the **external parasite,** because it lives on the outside of the host's body, e.g., in the hair or on the skin. The second type lives inside the body of the host, e.g., in the stomach, in the intestine, in the blood or in the lungs. These are known as **internal parasites.**

The louse

The louse is a very small animal. It lives on the hair of the host. It has three pairs of legs. There are claws at the end of each of these legs, and the louse uses these claws to cling to the hair. It clings so tightly that even the use of combs cannot remove it unless the teeth of the comb are very fine.

Though the louse does not cause any disease it can be the leading step to skin diseases. Its presence in the hair is a nuisance and causes the host to scratch; scratching may injure the scalp, and this injury may bring about skin diseases.

Another type of louse clings to the skin. This is a much smaller louse than the head louse. It lives in the pores of the skin. It pierces the skin with a beak and stays there. When it is hungry it sucks blood under the skin.

These two types of louse reproduce very quickly. They lay a large number of eggs, and within a week or so the eggs are hatched into baby lice. In a short time, a person may have a few thousand lice on his body.

Lice may not cause any sickness, but their presence on the body make the body unclean. They cause you to scratch, so that you feel uncomfortable and uneasy. Frequent scratching may damage the skin and allow germs to get into the body.

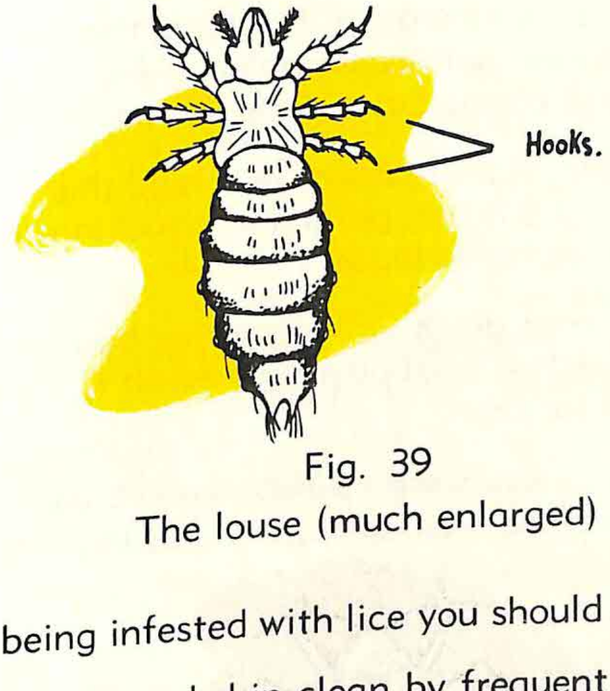


Fig. 39

The louse (much enlarged)

Prevention

To avoid being infested with lice you should do the following:

1. Keep your body and skin clean by frequent washing.
2. Take a bath at least once a day with soap and plenty of water; this will clean the skin of sweat and dirt.
3. Keep your hair short and clean.
4. Keep your nails short and clean, so that dirt and germs cannot stay under them.

Answer these questions:

1. What are the two types of lice you have studied?

....

2. How does the head louse cling to the hair so tightly?

....

3. Can lice cause sickness?

....

Then why is it important to get rid of them?

....

4. How does the louse on the skin get its food?

....

5. What are the ways to avoid getting lice?

....

The bed bug

The bed bug is another parasite. It lives in the cracks and holes of a wooden bed, coming out occasionally to feed on the host. It loves dark places and comes out to look for food during the night.

The bug is a small, flat creature. It is reddish brown. Its head is small and it has sharp biting parts and a sucking tube. When it feeds on a person it sucks his blood.

Bugs reproduce very quickly. The mother bug lays her eggs in batches. They are hatched into baby bugs which immediately leave their homes to look for food.

To get rid of bugs you need to keep your body clean, and to keep your house, your bed-linen and your clothing clean.

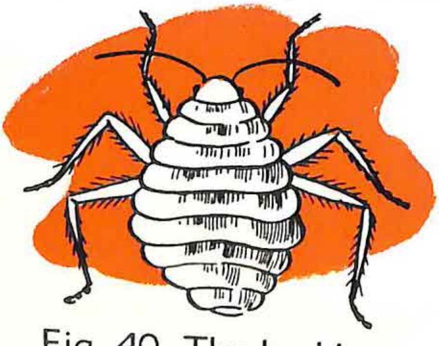


Fig. 40 The bed bug

Answer these questions:

1. Is the bed bug a parasite?

....

2. Why is this so?

....

3. When does the bed bug usually come out?

....

4. Where can you find bed bugs?

....

5. How does the bed bug get it's food?

....

6. What must you do to get rid of bed bugs?

....

7. Why is it difficult to get rid of bed bugs?

....

Round-worms

These are worms that live in the small intestine of man, particularly in children and in pigs.

A round-worm is like an earth-worm except that it is white or yellowish in colour. It is also thinner than the earth-worm. Its two ends are pointed. At one end is a mouth which has special kind of teeth; with these teeth the round-worm is able to cling to the walls of the small intestine. It stays there and feeds on the digested food of the host. Since food is easily obtained it need not move from place to place. For this reason the round worm has no eyes, ears, or legs. The round worm is not afraid of the **intestinal juice** because it has a thick, tough skin. When the mother round-worm is old enough it lays eggs. It lays a large number—20,000 a day. These eggs do not stay in the intestine for long, because they cannot hatch in there. They have to find another host.

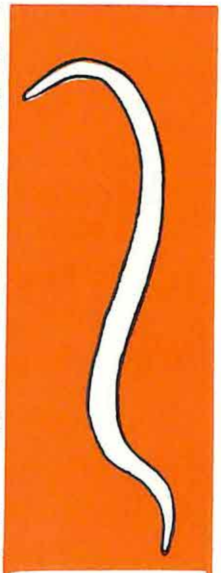


Fig. 41

The eggs mix with the food moving along the food tube, and are passed out with the waste matter.

For these eggs to become baby round-worms, they must get into the body of another host. Many of them die before they can do so. The question is how do the eggs of a round-worm get into another host's body? Here are some ways of preventing them:

Prevention

1. Do not eat fruit that has not been washed: the fruit may have been picked up from ground where there are round-worms' eggs. These stay on the fruit. When the fruit is eaten, the eggs are swallowed. The eggs move into the food tube and reach the small intestine where they hatch into baby round-worms.
2. Do not eat your meals without first washing your hands. Dirt on them may enable eggs to get into your body.
3. Do not walk barefooted in the garden. The eggs have been washed from some nearby place to your garden. They stay in the soil and wait for a victim. They can bore into the skin and into the blood.
4. Do not eat pork that contains round-worms' eggs. If the meat is not properly cooked before being eaten it may contain eggs which get into a host's body.

Round-worms cause a sickness called **diarrhoea.**

From studying the ways in which round-worms get into a new host's body, can you write down ways of preventing diarrhoea?

What happens if you have round-worms in your body?

If you have round-worms in your food tube, this is what happens. The food that you eat is taken by them, with the result that you feel hungry all the time. You are in fact not eating to feed yourself but to feed the round-worms. The waste matter given out by the round-worms also upsets the working of your body.

Answer these questions:

1. Is the bed bug a parasite?
   ....
2. Why is it so?
   ....
3. When does the bed bug usually come out?
   ....
4. Where can you find bed bugs?
   ....
5. How does the bed bug get its food?
   ....
6. What must you do to get rid of bed bugs?
   ....
7. Why is it difficult to get rid of bed bugs?
   ....

Answer these questions:

1. In which part of the body are round-worms found?
   ....
2. What other animal is usually attacked by round-worms?
   ....
3. How far is the round-worm different from an earth-worm?
   ....
4. How does the round-worm cling to the host's intestine?
   ....
5. How is the round-worm protected from the intestinal food juice?
   ....
6. Why does the round-worm need no eyes, ears or limbs?
   ....
7. Where do the eggs of round-worms go after they are born?
   ....
8. What must these eggs do in order to hatch into baby round-worms?
   ....

9. Name two ways in which round-worms get into the body of another host?

(i) ....

(ii) ....

10. What is the sickness caused by round-worms called?

....

Hook-worm

The hook-worm is another that lives in the intestine of man. It is so called because near its mouth are a number of hooks. By means of these hooks the worm is able to cling to the walls of the small intestine.

The hook-worm is pinkish in colour and is about half the size of your little finger. When it is about two weeks old the female hook-worm lays a large number of eggs. These are passed out with the waste matter. They need to enter the body of another person before they are hatched into baby hook-worms.

The way the young larva attacks another person is interesting. The larva has a piercing mouth which it uses to pierce a person's skin. It enters the blood vessel and follows the flow of blood round the body. It reaches the lungs and later the food tube; as it passes through the food tube it grows. By the time it reaches the small intestine it has grows quite a lot. When the worm is travelling round the body the person feels tired and ill. He must go to see the doctor.

A person can become ill with hook-worms through various ways:

(1) By drinking unclean water which may contain the eggs of hook-worms—and indeed of other worms. That is why water must be boiled before it is used for drinking and cooking.

(2) By walking barefooted in the garden or farm, where the damp soil may contain baby hook-worms.

Answer these questions:

1. How does the hook-worm attach itself to its host?

……………………………………………………………………

2. Where does it get its food?

……………………………………………………………………

3. Can the eggs or larvae be hatched in the host's body?

……………………………………………………………………

4. What must the eggs or larvae do in order to grow into young hook-worms?

……………………………………………………………………

5. Through what part of the body does the hook-worm get into a host's body?

……………………………………………………………………

6. How does a person feel when he has hook-worms in his body?

……………………………………………………………………

7. What are the signs to show you have hook-worms?

……………………………………………………………………

8. What are the ways a person can become infected with hook-worms?

……………………………………………………………………

Revision exercises

1. An animal that lives on the food of another animal is a ……………………… (animal parasite, plant parasite, free-living animal)
2. An animal or plant on which a parasite feeds is a ……………………… (host, guest, parasite)
3. There are two types of parasites. Those that live ……………………… the host's body and those that live ……………………… the host's body. (inside, outside)
4. A parasite usually lays a ……………………… number of eggs. (large, small).
5. A parasite is usually ……………………… than the host. (larger, smaller).

6. An example of a parasite that lives in man is .... (ring-worm, round-worm, louse).
7. A hook-worm clings to the walls of the small intestine by .... (hooks, jaws, teeth).
8. An example of a parasite that lives in the small intestine is the .... (ring-worm, hook-worm, louse).
9. Round-worms cause a disease called .... (diarrhoea, dysentry, typhoid).

CHAPTER 9

HOUSE AND GARDEN PESTS

There are many creatures which do not actually cause sickness but help to bring about diseases.

The common housefly is a pest that comes into our homes. It does not actually cause sickness, but its feeding habits help to carry germs to the food we eat.

A housefly can live only on liquid food. If you see how a housefly feeds then you will understand better how it carries germs.

This is how a housefly feed on a lump of sugar: it cannot take in the solid sugar, so it throws out some saliva from its mouth to dissolve the sugar. Then it sucks in the liquid sugar.

This dirty habit of throwing out saliva from its food tube frequently causes the fly to carry germs, because the same fly may have fed on foods that contain germs. These germs are sucked in and thrown out later when the fly feeds on our table food: the germs are passed on to the food. If we eat this food we may become ill. Another way in which the housefly carries disease is when it rests on dirty places and the germs or dirt cling to its hairy body. When it later rests on our table food, the germs or dirt are passed on to the food.

Mosquitoes

Mosquitoes are pests. There are some 2,000 types of mosquitoes. Some of these cause diseases. One particular kind of mosquito that carries **malaria germs** is known as the **anopheline mosquito.**

Unlike the housefly, the mosquito hunts at night. Normally it feeds on plant sap, but it also feeds on human blood. If a mosquito of the anopheline type sucks the blood of a person who has malaria, it becomes infected with malarial parasites. Then when it bites a healthy person it infects this person with the parasites; they get into his blood and give him malaria also.

How to get rid of mosquitoes

Mosquitoes live in dark places. The female mosquito goes to water to lay her eggs. The ways to get rid of mosquitoes are:

(i) To keep your home clean, and to allow as much sunlight as possible into your homes;
(ii) To turn over tins, bottles or other vessels that collect water; This will kill the eggs and baby mosquitoes.
(iii) To pour insect oil on stagnant water. This will also kill mosquito eggs.

GARDEN PESTS

Butterflies

In the life history of the butterfly, we found that the caterpillar feeds on the green parts of a plant, and that it is a ferocious eater. This eating habit can cause great damage to plants for, as you will remember, leaves are the organs that make plant food. The loss of too many leaves may kill the plant.

Locusts

A dangerous insect pest is the locust. A few locusts may not attract the attention of the farmer or gardener, but in many parts of the world locusts move in swarms. Within a few hours they destroy a large quantity of valuable food, like grains of rice or wheat. A cousin of the locust is the grasshopper. It devours the leaves of plants.

Garden snails

The pests that infest the garden at night are numerous, but the commonest are perhaps garden snails and beetles.

The snail has a soft body covered by a hard shell. During the day the snail withdraws its body into its protective shell and seals off the opening with a liquid. This liquid hardens and forms a film over the body. This prevents the snail from losing too much water in hot weather. During the day, the snail keeps away from the sun by staying under shady leaves, but during the night the snail crawls out to hunt for food. It moves with its elongated 'foot'. The underside of the 'foot' gives out a liquid to help its movement over the ground. The snail is guided by a pair of feelers or 'horns' at the front end. The pair of eyes is at the end of two tubes which can be withdrawn to enclose the eyes when touched.

Snail control

There is no easy method of destroying this pest. Some people bury them alive; others put them in lime. Whichever method is used, there is still the problem of getting rid of the shells. Vegetable gardeners have adopted the following measure to control the invasion of this pest: they plant their vegetable beds far away from rubbish heaps, keep the beds clear of leaves and put a fine netting over the raised beds.

Beetles

Beetles are not as destructive as snails. They infest the leaves of plants, and it is not uncommon to find as many as ten beetles feeding on one single maize leaf. This may damage the plant or even kill it.

Beetles often come out at night. Some, like coconut beetles, like to burrow into the trunk of trees.

Observe the types of pest that visit your school garden or home garden. Note particularly the types of plants they feed on. Try to find out where these pests come from.

PESTS AND PARASITES

Answer these questions:

1. Why do you think snails eat most of the young plants at the nursery? What ways would you suggest to get rid of them?

   ……………………………………………………………………………………

   ……………………………………………………………………………………

   ……………………………………………………………………………………

2. In what ways are earth-worms useful to the farmer or gardener?

   ……………………………………………………………………………………

   ……………………………………………………………………………………

   ……………………………………………………………………………………

3. "Caterpillars are such beautiful creatures. We should not destroy them," says Abdul Hamid. Do you think this is true?

....

....

4. Our teacher Mrs. Irani says: "When you walk in the vegetable garden you should wear shoes". Why does she says that?

....

....

5. "Washing your hands before meals is a good habit." Do you think that this statement is true?

....

6. "May I borrow your comb?" Eric asks Francis de Souza. "I can't let you have my comb", Francis replies.
Is Francis being selfish? Why can't Francis lend his comb?
Do you think he is being selfish?

....

....

7. Farmer Hari says: "Snails are common pests". Can you explain why he says that? What are the ways he can get rid of them?

....

....

8. Draw diagrams of pests that come to the house or garden here.

CHAPTER 10

THE MOON

The moon is a **satellite** of the earth. It is about 384,000 kilometers away from the earth. Scientists believe that there is no life on the moon as there is no air around it. The surface is covered with mountain ranges and deep craters.

The moon, like the earth, does not give out light or heat by itself. The light that comes to us from the moon is sunlight being reflected from the moon to the earth. The moon rotates round the earth once in $27\frac{1}{3}$ days. It also rotates on its own axis once in the same time, so the same half of it is always turned towards the earth. The face of the "man in the moon" does not change. The moon appears to have different shapes, because the part of the illuminated side seen from the earth varies. When we can see all the illuminated part (C) we say it is a full moon. When the illuminated part is turned away from us we say it is a new moon

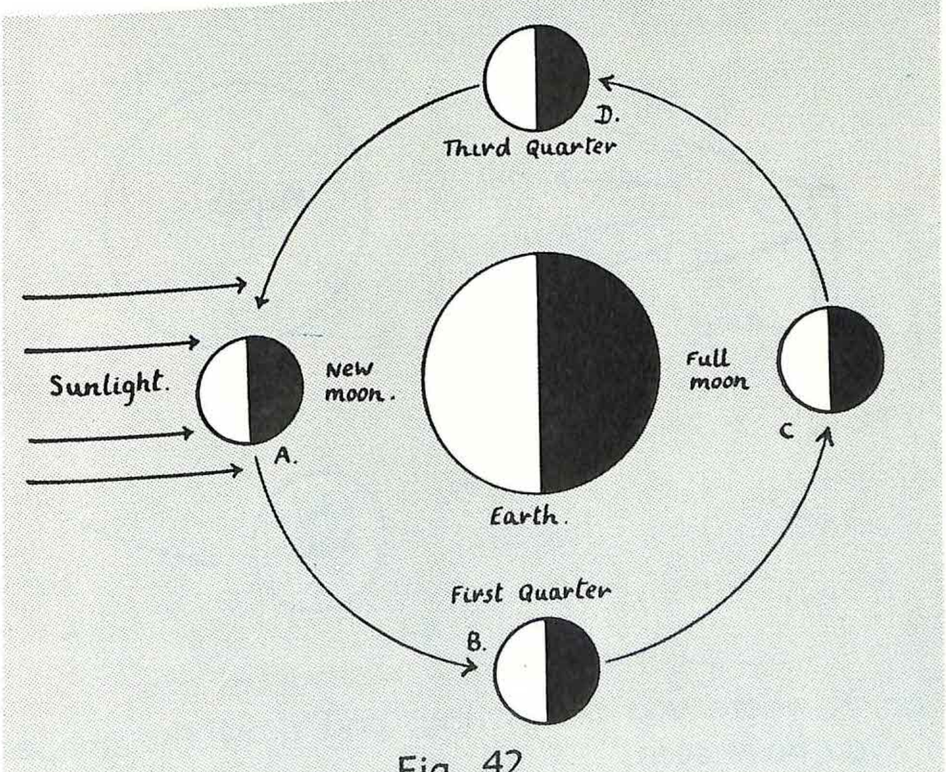


Fig. 42

(A). When we see the right-hand semi-circle (B) we say it is the first quarter; when we see the left-hand semi-circle (D) we say it is the third quarter.

It takes $27\frac{1}{3}$ days for the moon to go round the earth once. The time taken for the moon to go round the earth twelve times (i.e. 12 **lunar months**) is called the **lunar year.**

The time taken for the earth to move round the sun once is called the solar year. The solar year is longer than the lunar year by about 11 days.

In India people follow the lunar calendar in their religious and cultural activities. However, the official Indian calendar is based on the solar year and is being followed in all official correspondence from 1957.

Things to get: A white ball and a lamp.

Things to do: Let one pupil hold up the white ball so that it is illuminated by the lamp and walk in a circle round the rest of the class.

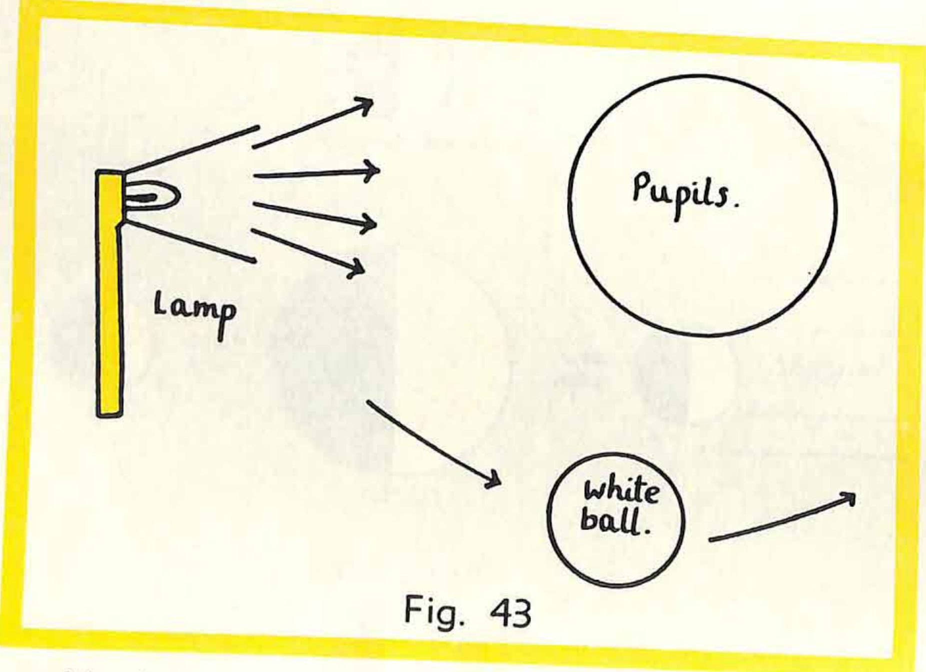


Fig. 43

Mark an X where you are sitting, and draw the shape of the "moon" you have seen.

Answer these questions:

1. It takes .... days for the moon to go round the earth once.
2. Sometimes we do not see the moon because it is ....
3. The moon gets its light from the ....
4. It takes .... days for the earth to go round the .... once.
5. There are .... days in a solar year.

Make drawings to show the shape of the moon on different days of the month.

CHAPTER 11

SOIL AND EROSION

Water and soil erosion

Three-quarters of the earth is covered with water to form the large oceans.

Water is one of the most important things in the world. Animals and plants need it. Fish and water plants live in it. Some water travels miles through mountains and hills, becomes a river and finally reaches the sea. On its way downhill it carries along pieces of rocks, soil and minerals. As it reaches some places the fine soil is deposited on the river bank. This soil is called **alluvial soil.** Usually a river does not follow a straight course. This is because a river may come across an area of hard rocks and cannot pass them easily, so it cuts across an area of soft rocks. This is called **meandering.**

The washing away of soil from the surface of the earth by water is called **soil erosion.** The loss of surface soil through soil erosion is considerable. If this is allowed to go on for a long time, much soil is transferred from one place to another. This is the problem many of our vegetable gardeners and farmers have to face, because if the top-soil of the garden plot or land is lost, plants will not grow well. The roots cannot hold the plant firmly in the soil. So the gardener must find ways and means to prevent erosion.

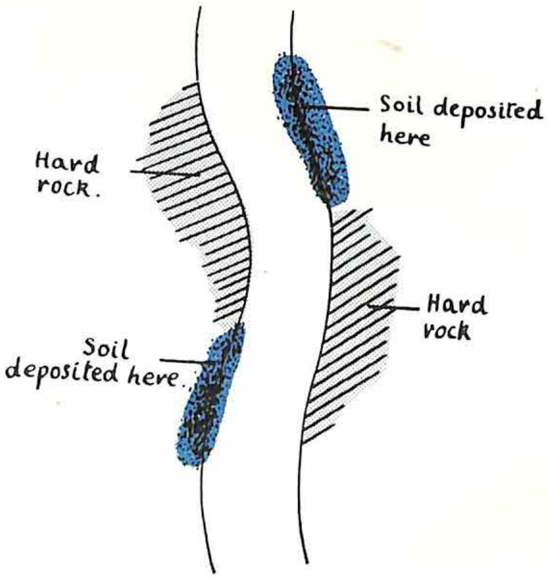


Fig. 44

One method we can use to prevent erosion is by growing plants to make a **cover crop.** The roots of these plants help to hold the soil together. Many of our rubber estates in the Nilgiris are planted with cover crops. Another method is by terracing the land, i.e., by cutting steps on the hillside. Many of our dry padi fields are planted on terraced land.

If you take a walk round housing estates you can see how soil erosion is prevented there.

EXPERIMENT: To find the amount of sand, clay and garden soil lost by erosion.

Things to get: A soil box, a watering can, a cigarette tin or any other tin, a piece of brick, a table, a biscuit-tin, and a teaspoon.

Things to do:

1. Fill the box with sand. Support one end with a piece of brick standing upright.
2. Place the biscuit-tin below the opening to collect the water that overflows and the sand, clay and garden soil that is lost.
3. Pour in five tins of water from the watering can.
4. When the water has stopped dripping remove the water collected.
5. Pour away the water carefully, leaving the sand behind. Measure the amount of sand, clay, and garden soil collected.

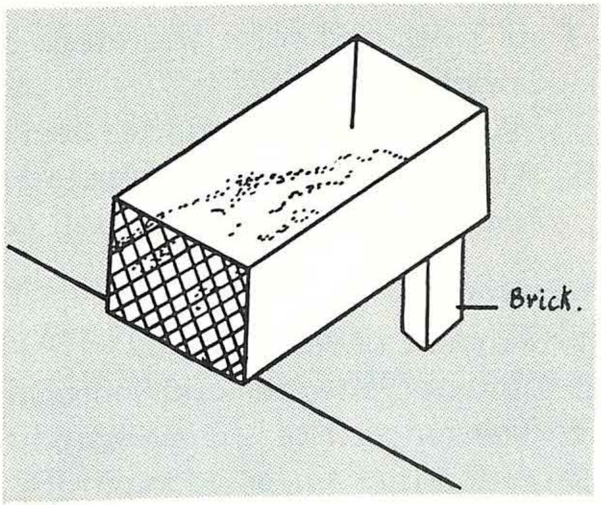


Fig. 45

Results:

1. Amount of water to sand, clay, garden soil = c.c.
2. Amount of sand, clay, garden soil collected = spoons.

EXPERIMENT: To find if the steepness of a slope makes soil erode more.

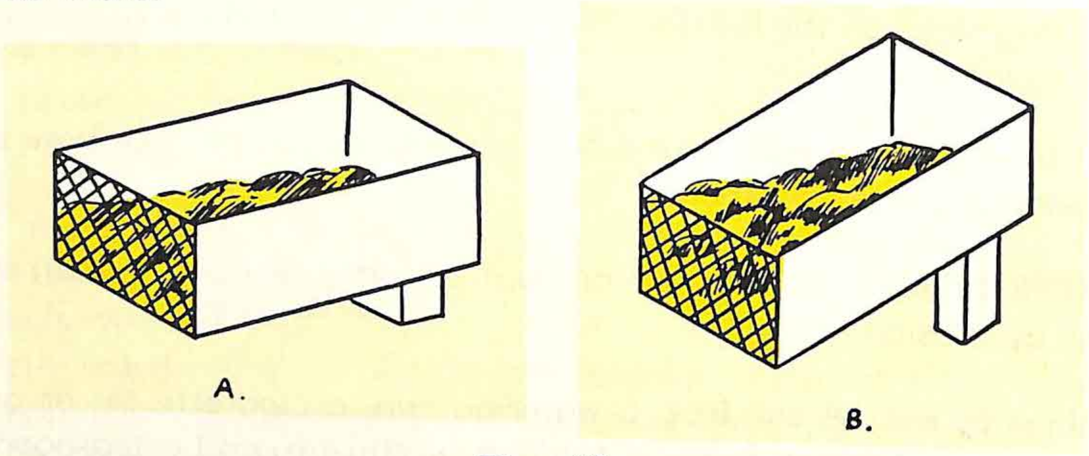


Fig. 46

Things to get: As for previous experiment.

Things to do:

1. Fill the boxes with equal amounts of garden soil.
2. Raise one end of one box on a piece of brick that is lying on its side, and raise the other box on a piece of brick that is upright.
3. Water the soil box and collect the soil and water lost.
4. After finding out the amount of water collected, pour it away. Measure the amount of soil collected in both experiments.

Results

1. Amount of water added in (A) .... c.c.
2. Amount of water and soil collected from (A) .... c.c.
3. The amount of soil collected from (A) .... grms.
4. Amount of water added in (B) .... c.c.
5. Amount of water and soil collected from (B) .... c.c.
6. The amount of soil collected from (B) .... grms.

EXPERIMENT: To find which type of furrow helps to check the loss of soil.

Things to get: Two soil boxes containing garden soil, a watering can, pieces of brick, a table and tin.

Things to do:

1. Arrange the apparatus as shown. Make one type of furrow as shown in (a) and the other as shown in (b).

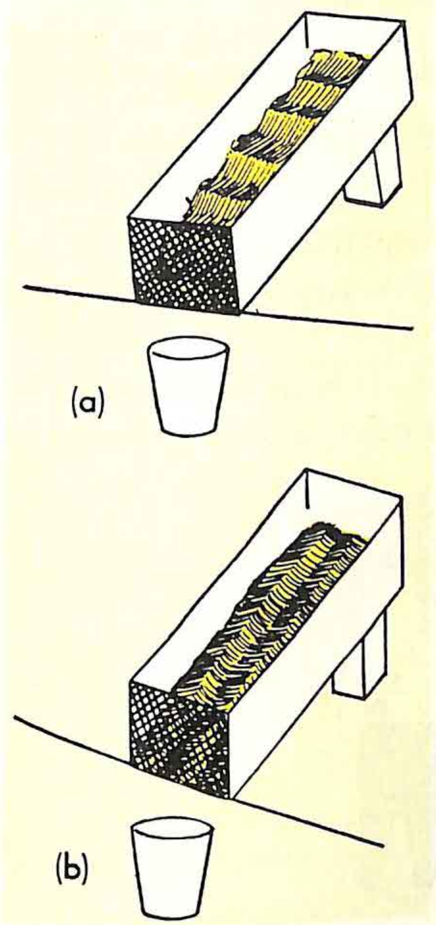


Fig. 47

2. Pour five cigarette tinfuls' of water from the watering can into each of the soil boxes.
3. Measure the water collected in each.

Results

1. Amount of water added to (a)............c.c.
2. Amount of water collected from (a)............c.c.
3. Amount of water added to (b)............c.c.
4. Amount of water collected from (b)............c.c.
5. Which type of furrow loses more soil?

....

From the experiments you have found that water flows downhill and carries with it surface soil. This is called **soil erosion.** If the soil is not protected, soil erosion will be very great. The loss by erosion will be very great. The steeper the slope, the more soil is eroded and lost. The two ways to prevent this loss are (a) by terracing, and (b) by growing grass on sloping ground.

Clayey soil can retain more water than sandy soil. This makes clayey soil very wet and heavy. Water does not pass through clayey soil easily. On the other hand water passes easily through sandy soil. Thus sandy soil is very porous and air can get into the soil. However, soil that contains both clay and sand is the best. Garden soil is like that. That's why garden soil is best for growing plants.

WATER CONTAINS AIR

EXPERIMENT: To show that water contains air.

Things to get: A plastic funnel, a test-tube, a beaker, a tripod, a spirit lamp and a shield.

Things to do:

1. Invert the funnel in water resting on two stones.
2. Fill the test-tube with water. Close the mouth of it and let it cover the funnel as shown.
3. Rest the beaker on the tripod and heat. It may be an hour or so before you see the results unless you have a strong flame.

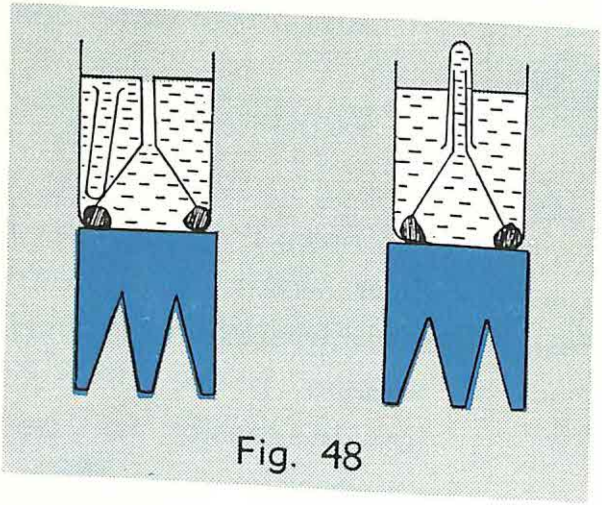


Fig. 48

Answer these questions:

1. Is the test-tube full of water?

....

2. After heating for 20 minutes, what can you see on the side of funnel and test-tube?

....

3. What is this?

....

4. What does this experiment show?

....

EXPERIMENT: To show that fish cannot live for long without air.

Things to get: Two small live fish, two bottles, oil, and boiling water.

Things to do:

1. Boil some water in a kettle.
2. Fill one bottle with boiling water and immediately add oil to form a thin film on the top of the water.
3. Fill the other bottle with ordinary tap water.
4. When the boiling water has gone cold, put a fish in each of the bottles. Record the time each fish can live.

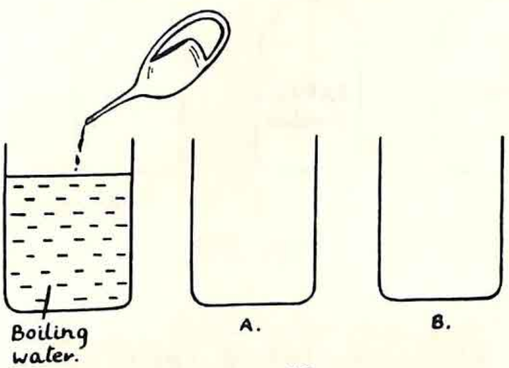


Fig. 49

Answer these questions:

1. What happens when oil is added to water? ....
2. Does the boiling water with a layer of oil contain air? ....
3. How long does the fish in A live? ....
   How long does the fish in B live? ....
4. What does this show? ....

CHAPTER 13

THINGS THAT DISSOLVE IN WATER

EXPERIMENT: To find which of the following substances dissolve in water.

Things to get:

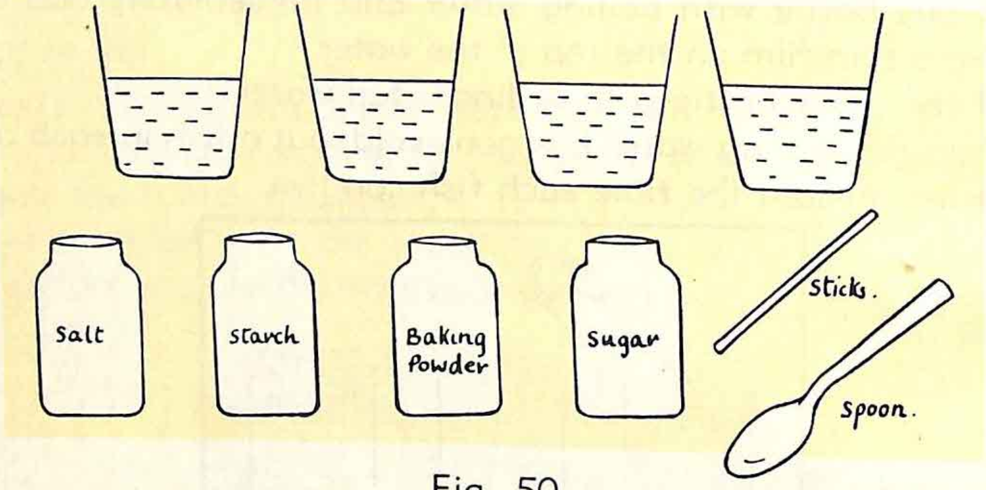


Fig. 50

Things to do:

1. Pour some of each substance onto a piece of paper and examine it.
2. Add a teaspoonful of each substance to glasses containing equal amounts of tap water.
3. Stir and then examine the contents. Do all the substances dissolve in water? Which ones do not dissolve?

Results

	Salt	Sugar	Starch	Baking powder
1. What is its colour?				
2. Is it coarse or fine?				
3. Does it dissolve in water?				

EXPERIMENT: To find which of the following substances dissolves in water.

Things to get: Limestone, sand and clay.

Things to do: Repeat the previous experiment with these substances and write your answers below.

Results:

	Limestone	Sand	Clay
What is its colour?			
Is it coarse or fine?			
Does it dissolve in water?			

Your experiment shows that some substances disappear when added to water. These substances are said to be **soluble** because they **dissolve** in water. Substances like starch and baking powder, however, do not dissolve in cold water and are said to be **insoluble.**

When a substance like sugar dissolves in water, no solid particles of sugar are left. The water that then contains sugar is called a **sugar solution.** Because starch does not dissolve in cold water, starch particles are seen floating in the water. When left for some time the particles go to the bottom. The water that contains undissolved starch is called a **starch suspension.**

EXPERIMENT 2: To compare how much of each of the following substances dissolves in equal amounts of water: Sugar and salt.

Things to get: Two wide-mouthed bottles, spoons, a measuring glass, filter papers, two funnels, and two small bottles.

Things to do:

1. Pour equal amounts of water (20 c.c.) into the two bottles.
2. Add one teaspoonful of sugar to the first bottle, and of salt to the second. Stir the solutions until as much as possible dissolves.
3. Filter the solutions and leave the filter-papers in the sun until dried.

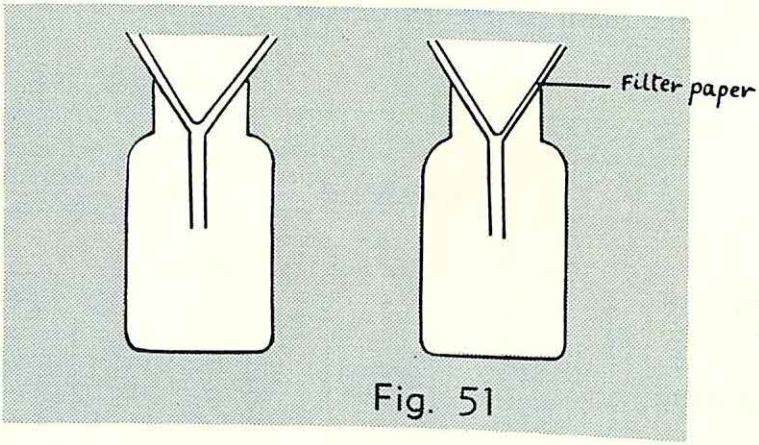


Fig. 51

Results

	Sugar	Salt	
1. How much is got back?			
2. Which dissolves most?			
3. Which dissolves least?			

EXPERIMENT 3: How to get back sugar from a sugar solution.

Things to get: A strong sugar solution, a watch glass, a water bath, a spirit lamp, and boiling water.

Things to do:

1. Make a strong solution by adding five teaspoonfuls of sugar in 30 c.c. of water. Stir the solution until most of the sugar dissolves. Filter the solution to remove any sugar that has not dissolved.

2. Fill the watch glass with two teaspoonful of sugar solution.
3. Place the watch glass over a water bath, as shown below.

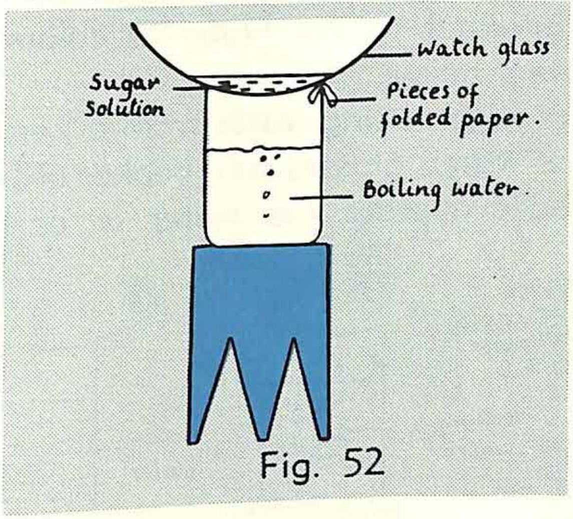


Fig. 52

Results

1. What happens to the solution in the watch glass?

....

2. What is left on the watch glass?

....

3. Does this look like the original sugar?

....

EXPERIMENT 4: To study the different kinds of water.

Things to get: Three watch glasses

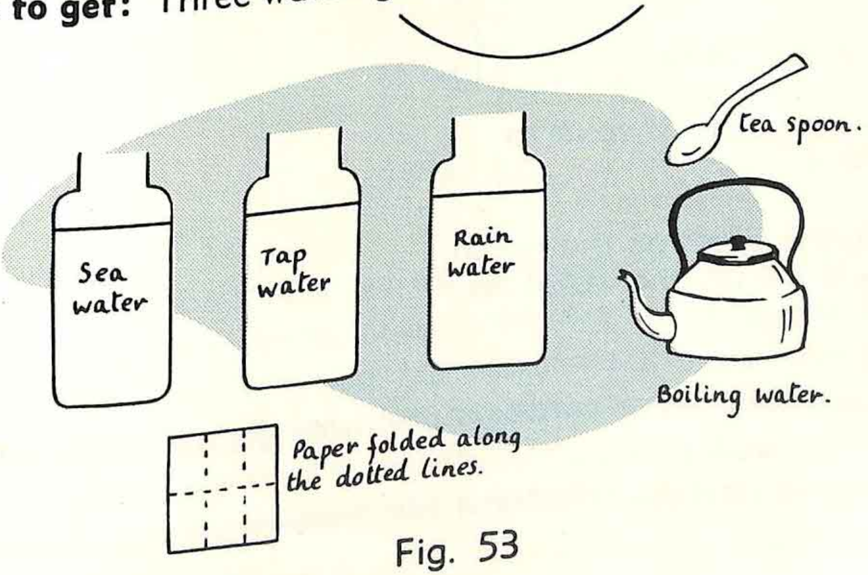

tea spoon.
Sea water
Tap water
Rain water
Boiling water.
Paper folded along the dotted lines.

Fig. 53

Things to do:

1. Pour a teaspoonful of (1) sea water; (2) tap water; (3) rain water into each watch glass. Note its colour and taste it. Write your answers below.
2. Fill three beakers with boiling water from a kettle.
3. Place each of the watch glasses on a beaker of boiling water as shown below and evaporate the water in each watch glass completely.

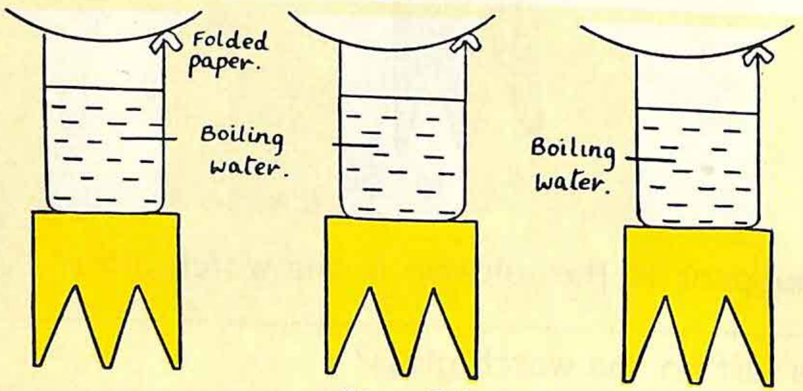


Fig. 54

Results

	Sea water	Tap water	Rain water
1. Is it clean or muddy?			
2. Has it any taste?			
3. How long does it take to evaporate?			
4. Is anything left on the watch glass after all the water has evaporated?			

5. Which kind of water contains the most dissolved matter?

....

6. Which kind of water contains the least dissolved matter?

....

CHAPTER 14

MEN AT WORK

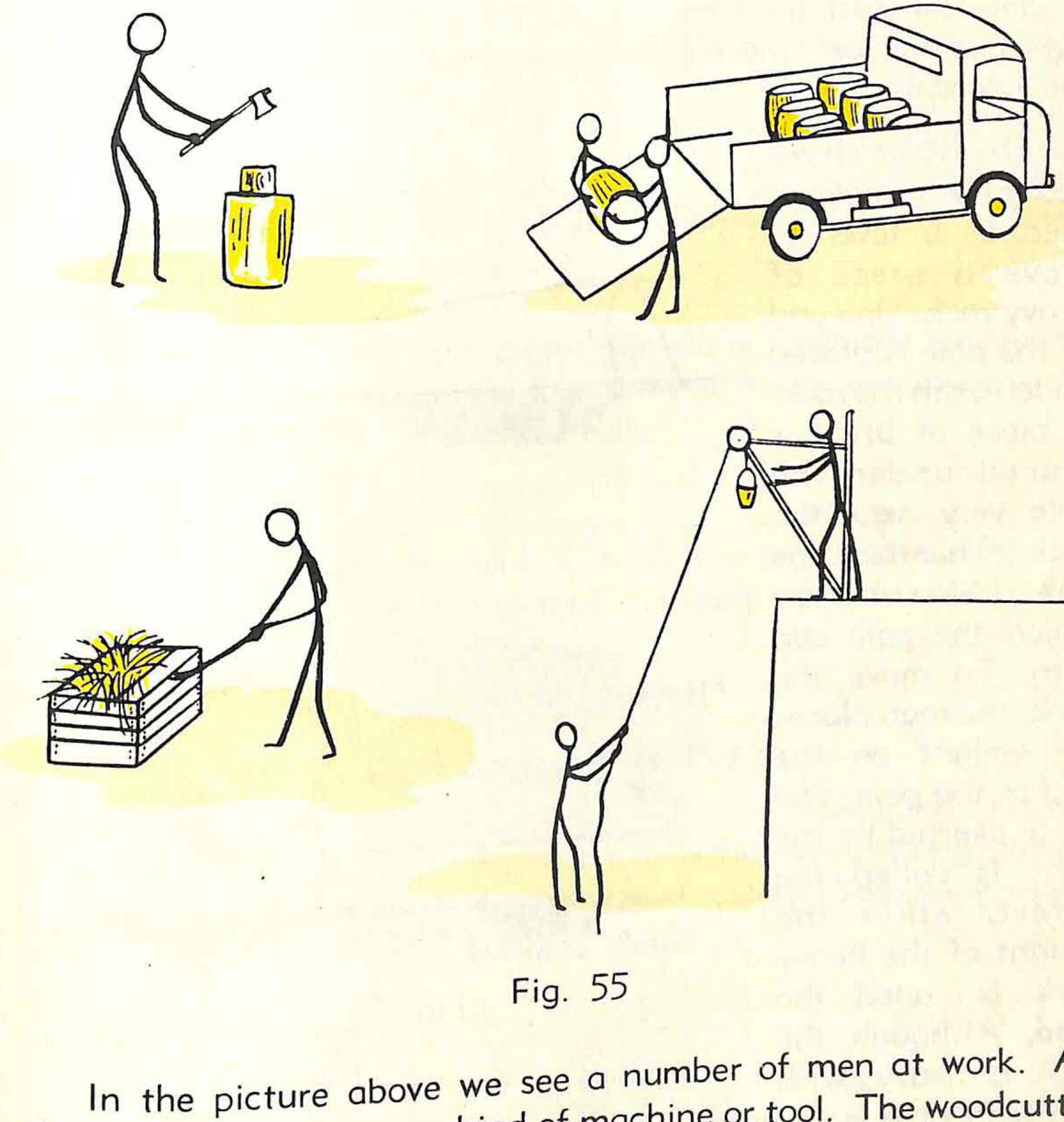


Fig. 55

In the picture above we see a number of men at work. All these men are using some kind of machine or tool. The woodcutter uses an axe to cut firewood, the labourers use a piece of plank to load heavy boxes of goods, the builder uses a pulley to lift bricks, and the shopkeeper uses a crowbar to open a box. The axe, the plank that is supported on the lorry, the pulley and the crowbar are simple **machines.**

Many people in our city make a living by doing **manual** work. These people have tools or machines to help them in their work. Can you name some useful machines that make work easier?

The simplest machine we are going to study is the **lever.** A lever is a pole or a piece of plank that moves about a point called the **fulcrum.**

The figure shows you how a pole is used as a lever to move a piece of heavy rock. One end of the pole is placed underneath the rock. A piece of brick is placed under the pole very near the rock. This acts as the fulcrum on which the pole can turn. To move the rock, the man places his weight on the end of the pole. The force exerted by the man is called the **effort,** while the weight of the heavy rock is called the **load.** Although the rock is heavy, with the help of a pole used in this way the man can move the rock. Where should the man press down so that he can move the rock easily? The further away the effort is applied from the fulcrum, the easier it will be for him to move the rock. There are many tools we use every day that are levers. A few of them are shown in Figure 57.

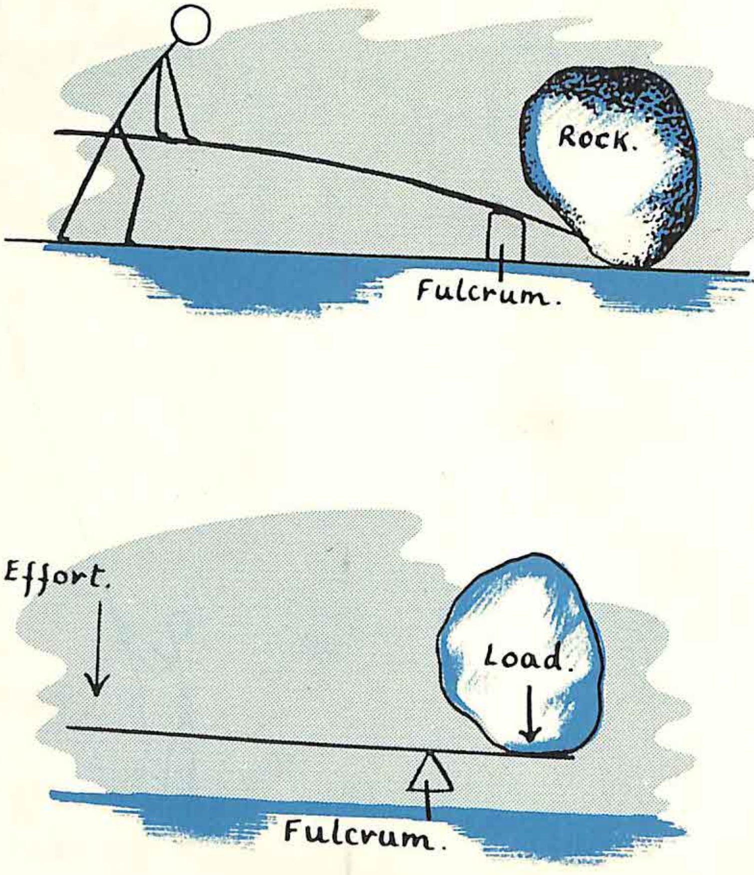


Fig. 56

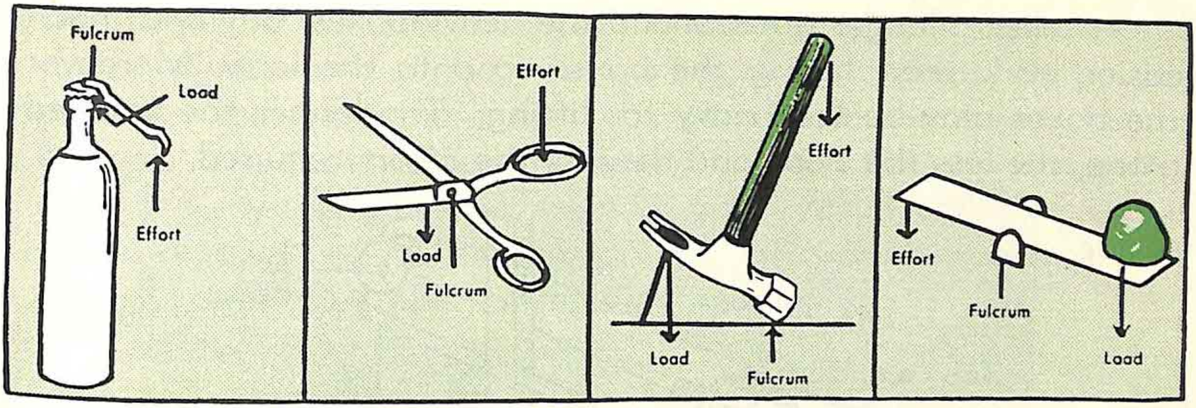


Fig. 57

Things to do:

1. Hammer some nails into a piece of plank. Remove the nails with the claw end of the hammer. Where should you place your hand to remove the nail most easily?

   ....

   ....

2. Try to cut a piece of stout wire with a **wire cutter.** Where should you place the wire so that the least effort is used?

   ....

   ....

AN INCLINED PLANE

You may have seen labourers loading or unloading goods. Sometimes the men use a crane. Often the men use a strong plank. It is sloped against the side or back of the lorry. The plank used in this manner is called an **inclined plane.**

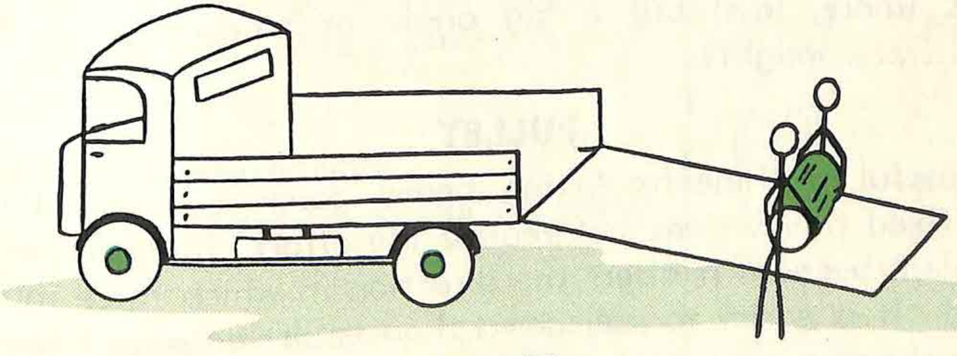


Fig. 58

It takes a longer time to load the heavy boxes, but it is much easier work than lifting the boxes up onto the lorry. Moreover the boxes may be too heavy for lifting. The longer the inclined plane, the less the slope and the less the effort required.

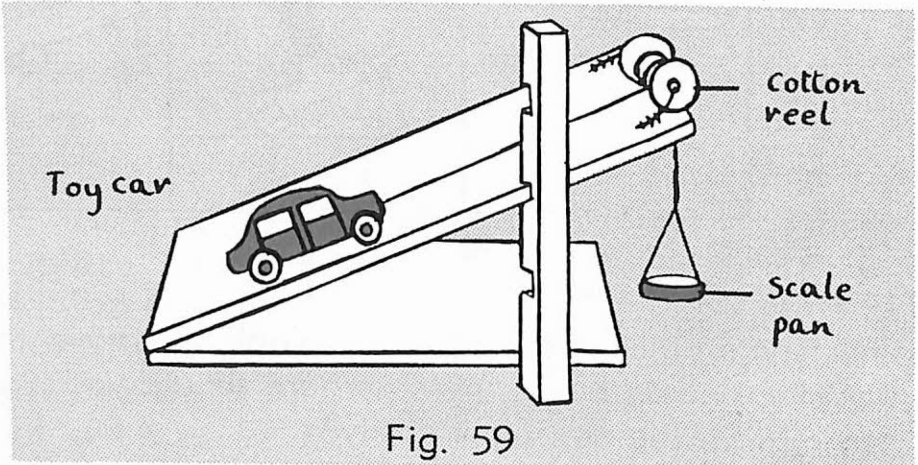


Fig. 59

Things to do:

Set up an inclined plane as shown in the figure, with string from a toy car passing over a cotton reel fixed to the top of the plane. The stick can be adjusted so that the inclined plane slopes at different angles. Put pieces of stone or weights on the scale pan, and see how the weight needed to pull the car up the plane varies with the angle of the plane.

A small angle = ... kilos.
A big angle = ... "
A bigger angle = ... "

Hence a small angle and a gentle slope needs............................... weights (more, less) but a big angle or steeper slope needs .... weights.

PULLEY

A useful machine for lifting heavy goods is the **pulley.** A single fixed pulley does not reduce the effort required, but it is convenient because it alters the direction in which force must be exerted. It is easier to pull down than to lift an object up. The picture shows a man using a single pulley. The pulley is fixed or tied firmly to the end of a pole. A piece of rope passes over the pulley. On one end of the rope is a bucket of cement. By pulling on the rope over the pulley the man hoists up the bucket of cement. It is easier to pull the cement up with the help of a pulley than to carry the cement up steps. A pulley arranged in this way is called a fixed pulley. Pulleys can also be arranged so that they move. These are called **movable pulleys.**

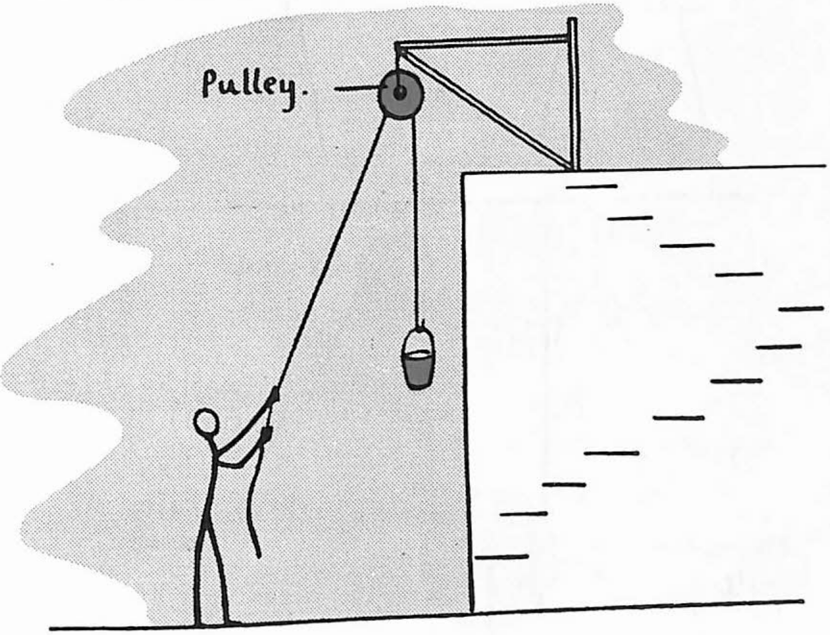


Fig. 60

Things to do:

You, too, can make pulleys from empty cotton reels and stout wires as shown in the diagrams. Cut off the ends of a cotton reel. Stick them together with strong glue. Bind a piece of stout wire to make a hook.

Experiments with pulleys

Use the pulleys to do the following experiments.

Get a stick, two chains and two desks, and a book. Arrange them as shown in

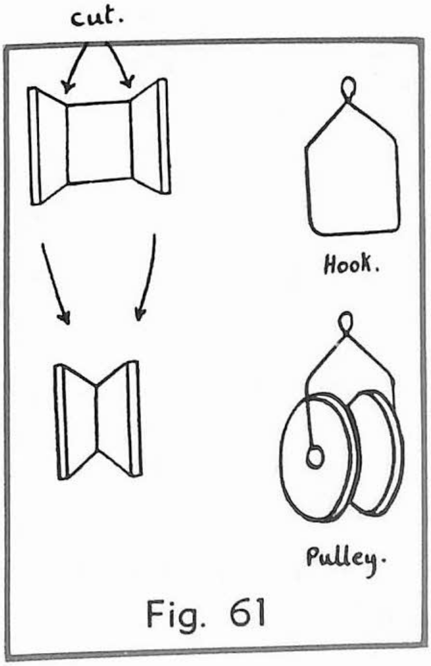
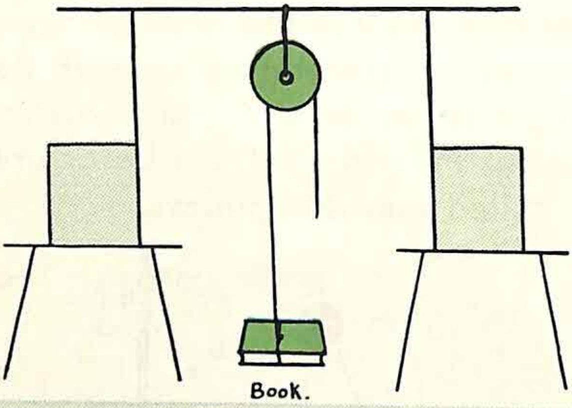


Fig. 61

the diagram. If you pull down on the string fifty centimeters, how far does the load (the book) move?



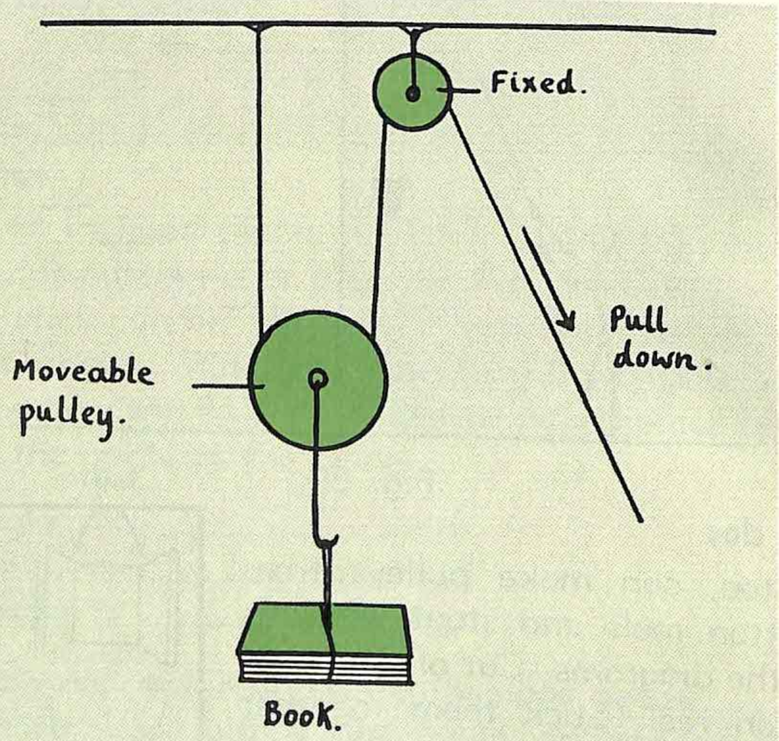


Fig. 62

Arrange the pulleys in another way as shown.

If you pull the string down fifty centimeters, how far does the load (the book) move?

Is it easier to lift the book using this arrangement of two pulleys?

Block and tackle

Pulleys can also be arranged in other ways as shown. This arrangement is called a **block and tackle.**

The block and tackle is very useful for lifting heavy loads.

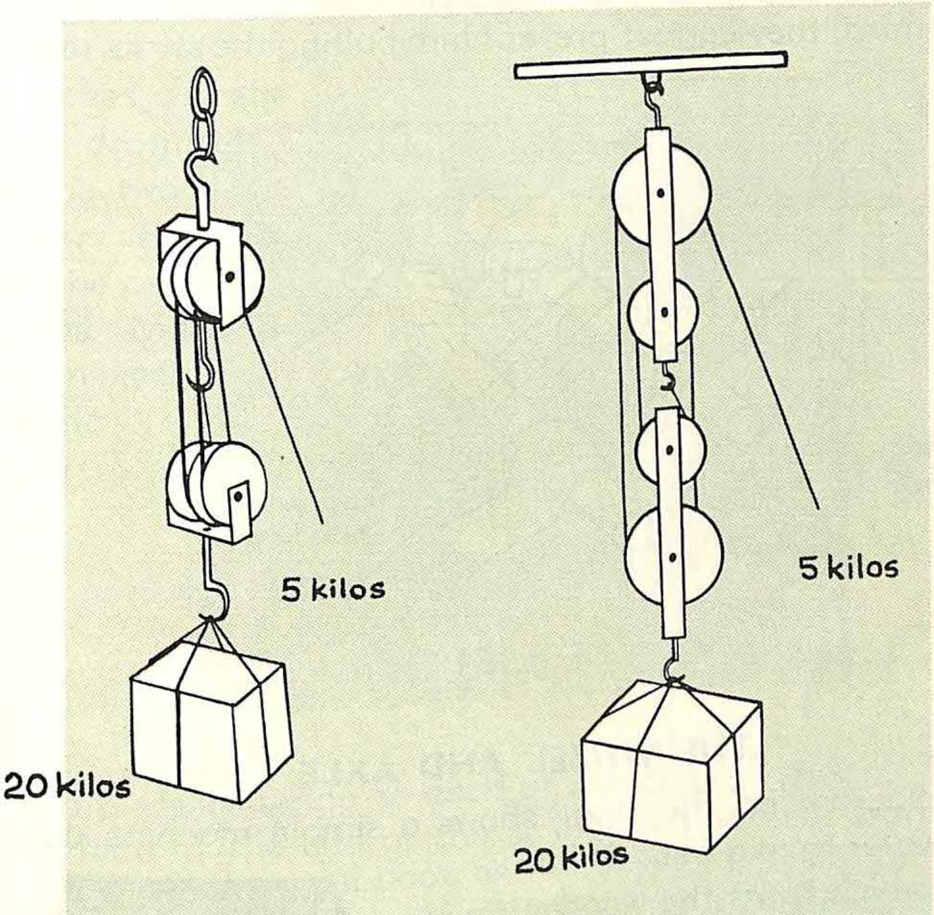


Fig. 63

In each block and tackle there are four pulleys with four ropes passing round them. You will find that to lift a 20 kilo load you need only use a 5 kilo effort, but you must pull the rope four times further. For example to lift the load one foot you have to pull the rope four feet. A block and tackle is a very useful machine, for with little effort a person can move a heavy load. A simple experiment to show how the block and tackle works can be done by three pupils.

Things to do:

Get two round sticks. Tie a piece of rope to one stick as shown. Wind the rope round and round the sticks. Two pupils hold the sticks about two feet apart. A third pupil tries to pull the two stick together. Although the first two pupils are exerting more force than the third, they cannot prevent him pulling the sticks together.

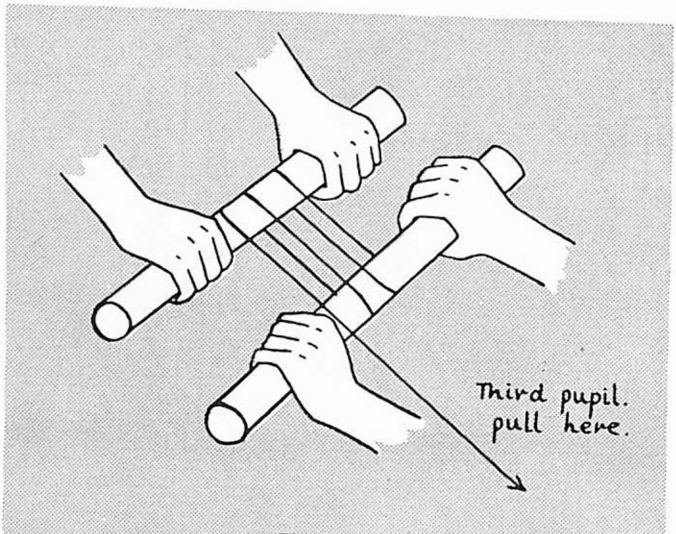

Third pupil.
pull here.

Fig. 64

THE WHEEL AND AXLE

The diagram on the right shows a simple machine used for drawing water from a well. It has a handle which turns the wooden cylinder. A piece of rope is wound round the cylinder. The piece of rope can be wound or unwound by turning the handle. This machine is called a **wheel and axle.** The wooden cylinder is the axle. A small effort can lift up a heavy load; a small child is able to draw a pail full of water by turning the handle.

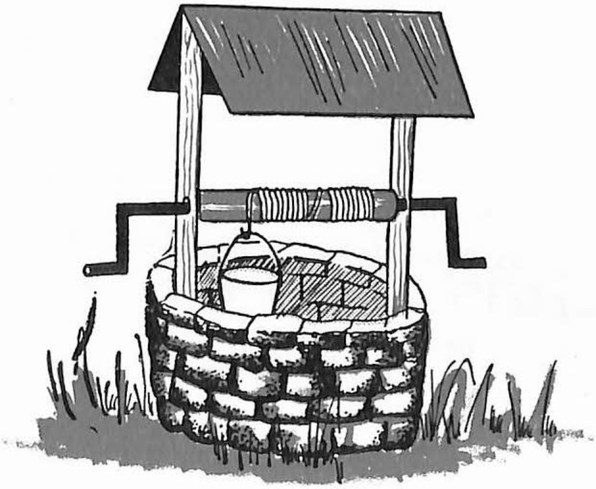


Fig. 65

Things to do:

To make a wheel and axle. Get a large piece of thick board or plywood. Cut out circular discs of three inches and six inches diameter. Screw the two discs together. Bore a hole in the centre of the discs. Make a groove in each disc with a file.

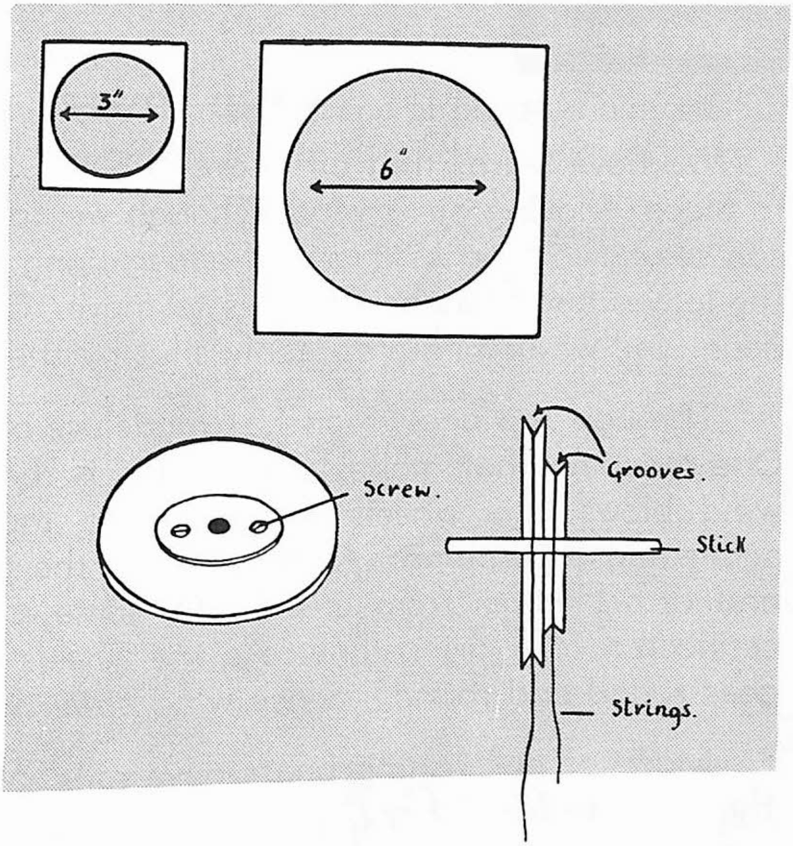


Fig. 66

Tie a piece of string to each of the discs as shown. Tie a big book as **load** at the end of the string that is wound around the smaller disc. Tie a small book as **effort** at the end of the string that is wound around the larger disc. Does the small book lift up the big book?

Which is lighter, the big book or the small book? Does this show that only a small effort is needed to lift a big load? You can see that with the help of a wheel and axle, a small effort can lift a heavy load.

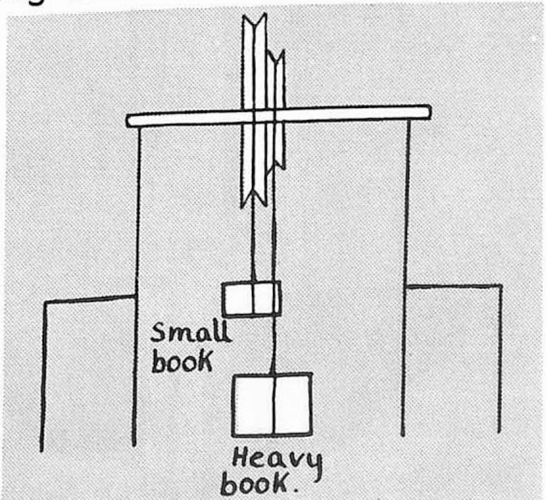


Fig. 67

CHAPTER 15

WIND POWER

We have learnt that air is everywhere. Air moves from place to place. Moving air is wind. Though we cannot see the wind we can see how it carries dust and paper along the floor, and causes the leaves and branches of trees to move. On a windy day, open doors and windows are suddenly shut by the power of the wind.

Through the ages, man has made use of the wind to do work. One machine that makes use of wind is the windmill. When the wind blows, the wheels are made to move. The wheels are connected to a pump. As they move, the pump begins to work and draws water from a well. In some cases the wheels are connected to a grindstone. As the wheels move, the grindstone goes round and round. Hence wind power helps man in his work.

Many of our fishing boats have sails. When the wind strikes the large surface of the sails, the boat is pushed along, and the fishermen need not use their engines.

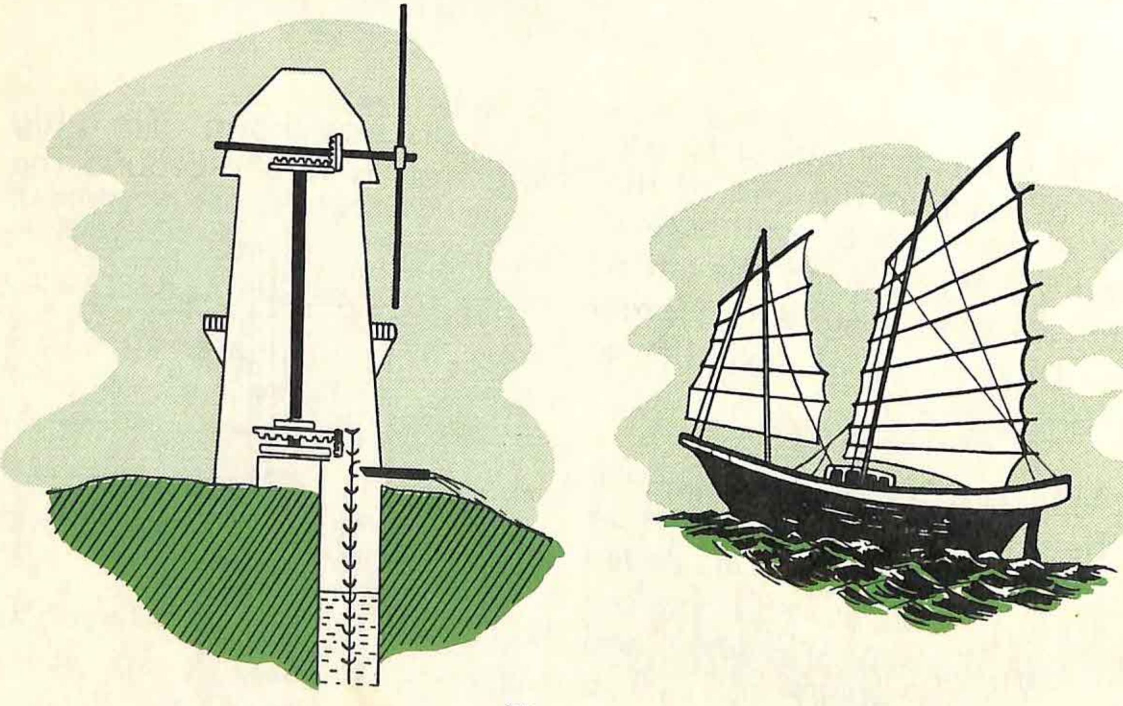


Fig. 68a

Things to do:

To make a windmill cut a square piece of paper. Fold and cut as shown. Push a pin through the centre of the windmill.

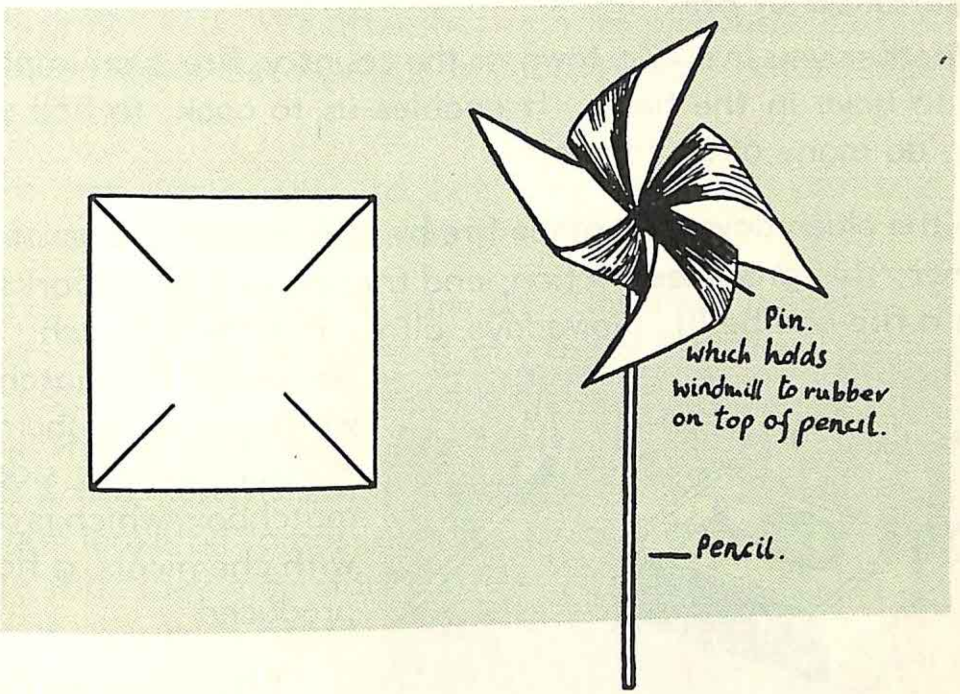


Fig. 68b

Flowing water, too, is powerful. As it flows along as a river or stream, it carries away soil, stones and pebbles. When water flows over hard rocks from a great height, a waterfall is formed. Those of you who have been to Gersoppa Waterfalls will have seen how powerful running water can be.

Man makes use of water to produce electricity for lighting.

To produce electricity in this way a dam is built across a deep valley. Water is allowed to flow into strong pipes. As water enters the pipes it exerts a great force. The water is directed against the blades of a machine called a turbine. The blades begin to move at great speed, and drive the generators which produce electricity.

In India, many huge hydro-electric plants have already been set up, as at Bhakra, Koyana, etc., and are being used for generating electricity.

CHAPTER 16

FIRE—ITS USEFULNESS AND ITS DANGERS

The usefulness of fire

Whether you live in a town or the country, fire is an important thing to have in the home. It enables us to cook, to boil water, and to do many other things.

In the olden days man made fire by striking two pieces of stone together; this produces friction, and friction produces sparks from which a fire can be lit. Nowadays, all we need is a match. When one end of the matchstick, which contains chemicals, is struck on the side of a matchbox, which is coated with chemicals, a flame is produced.

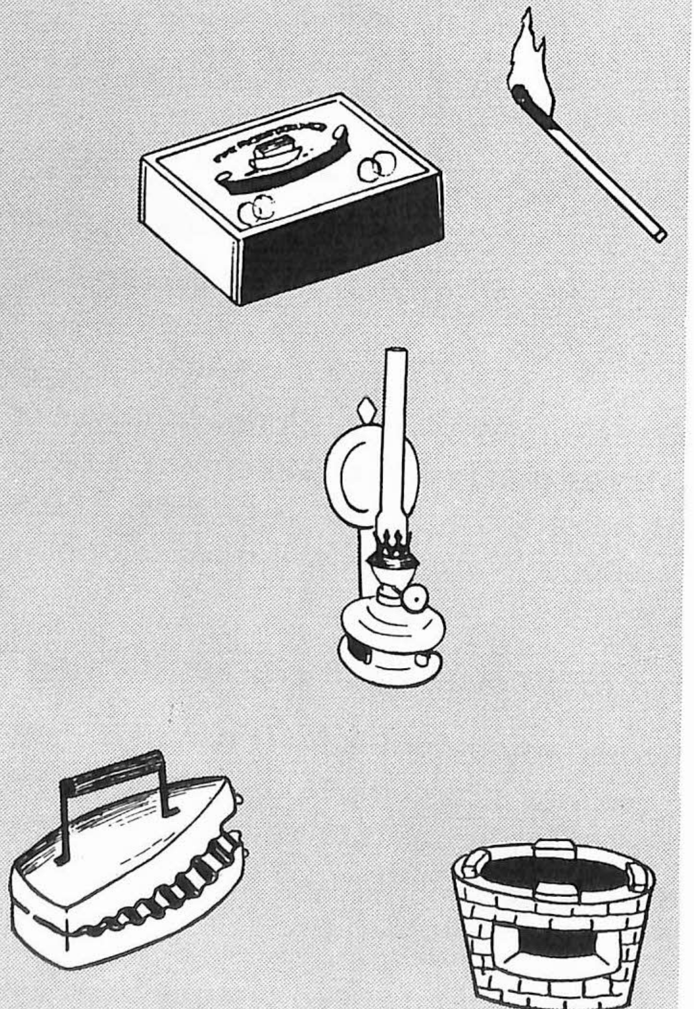


Fig. 69

The matchstick cannot burn long enough to give us a fire on which to boil a kettle of water. So we need something that can burn longer to produce a fire, i.e., we need **fuel.** Many things can be used as fuel, for example, oil, charcoal, coal, kerosene and petrol.

The fire produced by burning charcoal in an iron makes it hot for pressing clothes. The fire in the steam furnace of a train boils the water and turns it to steam which drives the engine. Now some of our Indian trains use diesel oil as a fuel.

On the other hand, fire can also be a danger if it is not properly controlled. We often hear stories of houses and factories being burnt down because the occupants were not careful about the use of fire.

Here are some rules to help to safeguard you and your neighbours from the danger of fire.

1. Do not play with fire or burn anything near houses.
2. When a fire is not needed any more, it must be put out immediately.
3. **Keep things that catch fire easily, for example petrol, away from a fire.** Keep them in a cool place.
4. Do not leave oil lamps, candles, or cigarette stumps in such a place that they may start a fire.
5. Do not play with fire-crackers in the house.

A fire extinguisher

Here is a picture of a red appliance which you may have come across hanging on the walls of your school. It is called the ....
....

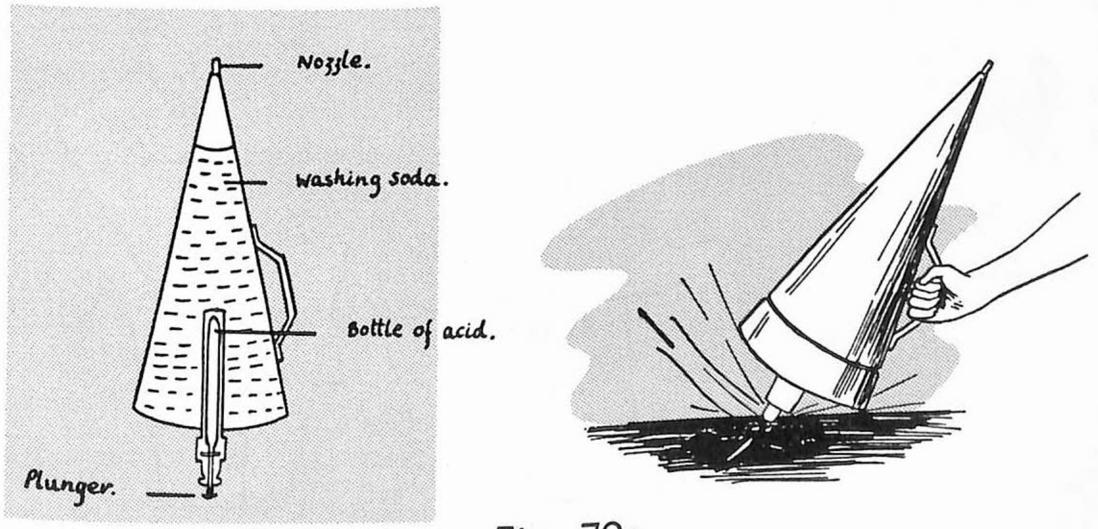


Fig. 70a

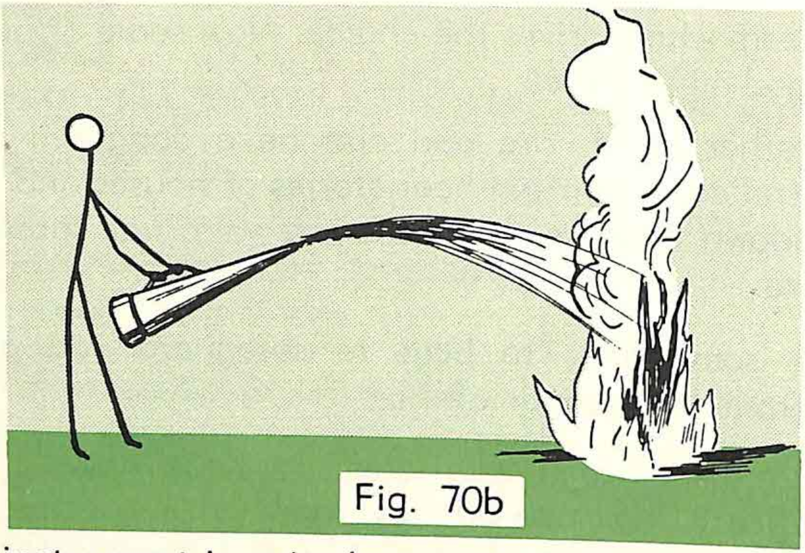


Fig. 70b

This instrument is quite heavy. At the base you can see a thing called the **plunger.** Connected to it is a bottle containing **sulphuric acid.** Surrounding this is a liquid called **washing soda.** At the top is a **nozzle.** When the plunger is pressed down by striking it on the floor (see figure 70a) the bottle is broken and the acid within mixes with the soda. When this happens carbon dioxide is made. This gas forces a jet of liquid out through the nozzle and this puts out the fire.

EXPERIMENT: To show that carbon dioxide can put out a fire.

Things to get: A glass, candle, three or four wide-mouthed bottles, and a glass tube.

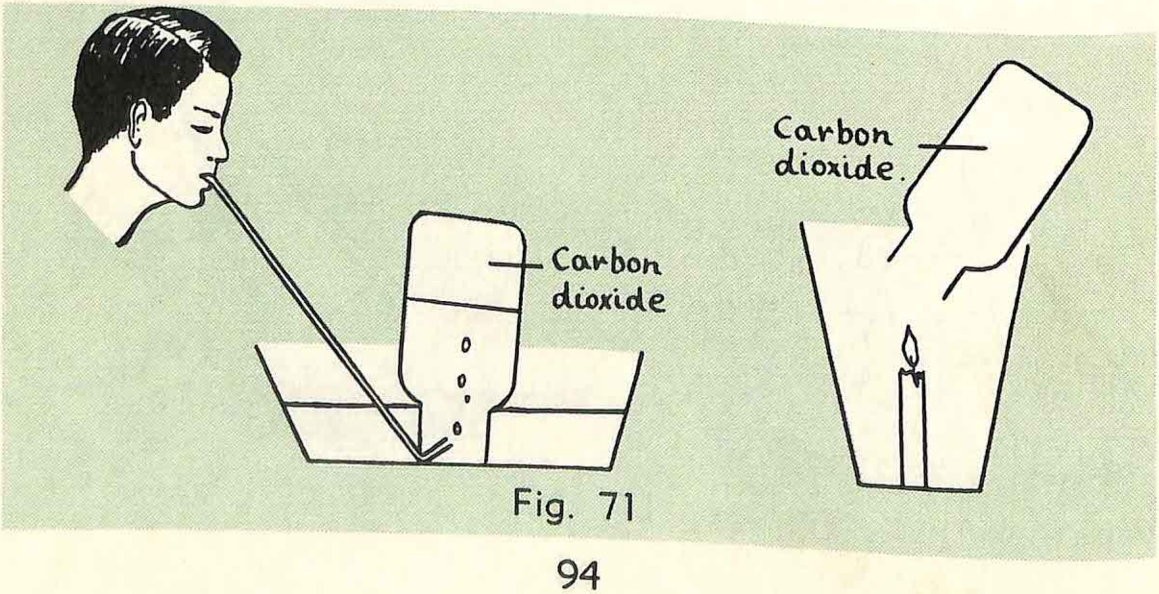


Fig. 71

Things to do:

1. Fill a bottle with water. Cover it with a glass cover and put it carefully into a bowl containing a few inches of water.
2. Insert the glass tube into the bottle and breathe out until the water is completely driven out. Put a cover over the bottle and slowly remove the bottle, which now contains some carbon dioxide.
3. Do the same with the other three bottles.
4. Light a candle and put it inside a glass.
5. "Pour" the bottles containing some carbon dioxide on to the burning candle. When you do this make sure that there is no breeze.

Answer these questions:

1. What gas is collected in the bottles when you breathe into the glass? ....
   ....
2. When you "pour" in the bottles containing carbon dioxide will it go into the glass? ....
3. Why does it sink into the glass? ....
   ....
4. Does the candle flame go out?..
5. What does this show? ....
   ....

EXPERIMENT: To make a fire extinguisher.

Things to get: A wide-mouthed bottle, a cork with a glass tube (the end of the tube is made small), vinegar, baking powder, and a piece of thread.

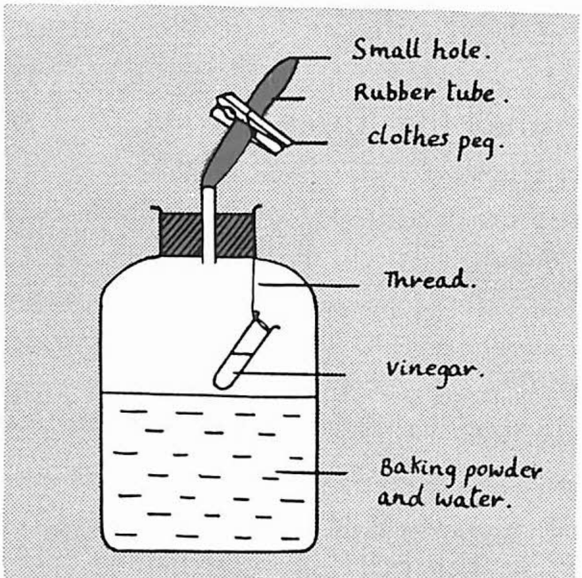


Fig. 72

Things to do:

1. Half fill the bottle with water and baking powder.
2. Put a glass tube containing vinegar into the bottle. (The vinegar must not touch the baking powder).
3. Carefully insert the cork and allow the tube to drop into liquid.
4. What happens?

CHAPTER 17

WEIGHING MACHINES

When you want to find out the weight of anything, for example, a parcel, you use a weighing machine.

A simple weighing machine is a spring balance. It has a piece of spring inside a metal case. When it is not used, the marker is at the O mark. When something is hung on the balance, the spring extends. The marker then shows the weight of the object.

The spring balance is marked in grams or in pounds. Some spring balances only weigh light objects, but a strong one can be used to weigh luggage taken when travelling by air.

Let us study the machine. It has a wooden rod with the scale marked on it. At one end of the rod is the scale-pan. We hold up the machine by a piece of string. When something is placed on the scale-pan, the rod tilts to one side. A small weight is slid along the rod until the rod is balanced. By reading the distances of the scale-pan and the weight from the string you can calculate how heavy the object is. If the object is five centimeters from the string and the weight is ten centimeters from it, the object is twice as heavy as the weight.

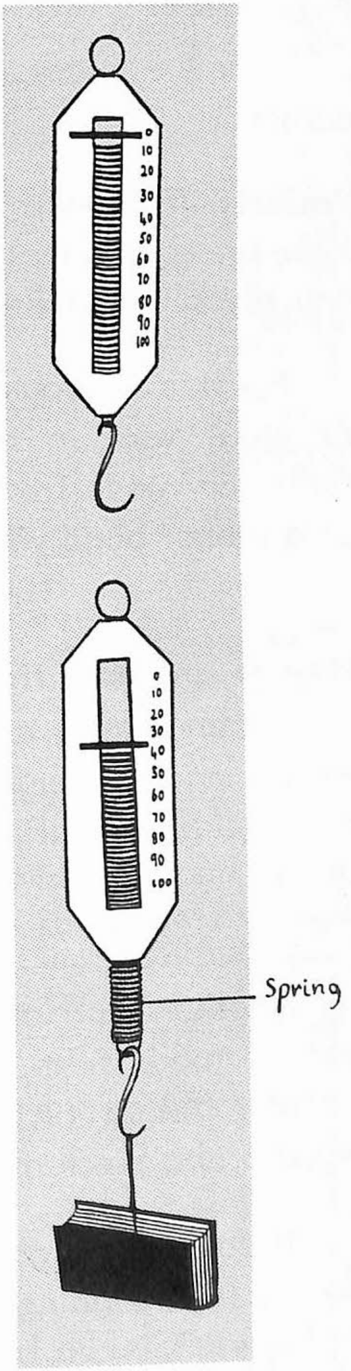


Fig. 73

Things to do:

Next time you go into a shop look for the weighing machine. See what kind of scale is used. Do not be surprised to find a weighing machine which has one type of scale measuring weights in grams and kilograms.

Examine other types of weighing machines that you come across.

Projects—To make weighing machines. Here are some simple weighing machines which you can make at home or in class.

For this one you need a stand, a piece of stout wire, a rubber band and a scale-pan made from a tin lid. Instead of a rubber band you can use a spring.

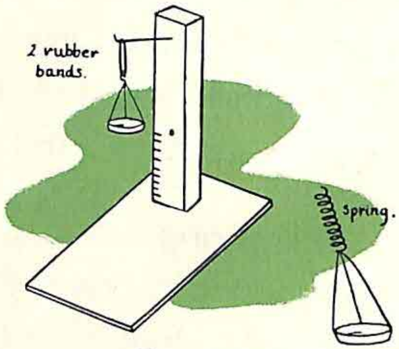


Fig. 74

How to graduate the scale

Put an O mark at the end of the weighing pan. Put a ten-gram weight on the weighing pan. When the weighing pan is steady mark 10 to show that it is 10 grams; put in another ten-gram weight and mark the weight as 20, and so on.

Another kind of spring balance can be made from a bed spring, a circular biscuit tin cover, pieces of wood and a piece of plywood.

If you have a saw blade or clock spring the weighing machine shown in Figure 75b can be made.

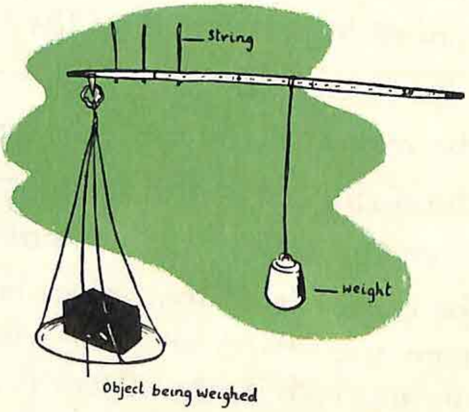


Fig. 75a

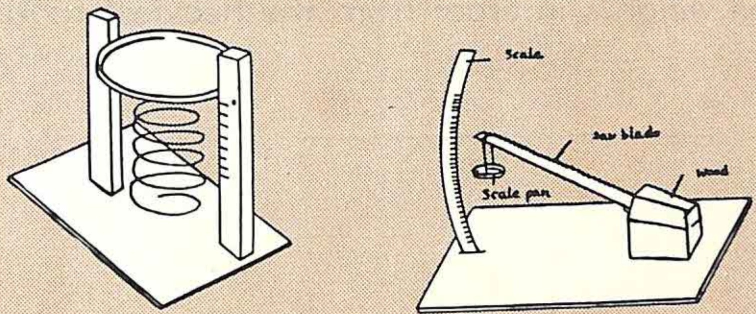


Fig. 75b

EXPERIMENT: To compare the weights of some common materials.

Things to get: A spring balance, and a tin full of each of the following; sugar, starch, salt, sand and garden soil.

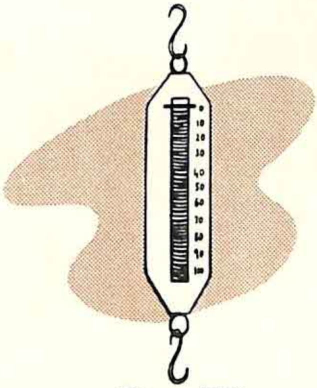


Fig. 76

Things to do: Weigh the various objects with the spring balance and write your results below:

Results:

Materials	Weight in grams
a tin of sugar	
a tin of starch	
a tin of salt	
a tin of sand	
a tin of garden soil	

Write the weights in order from the heaviest material to the lightest:

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